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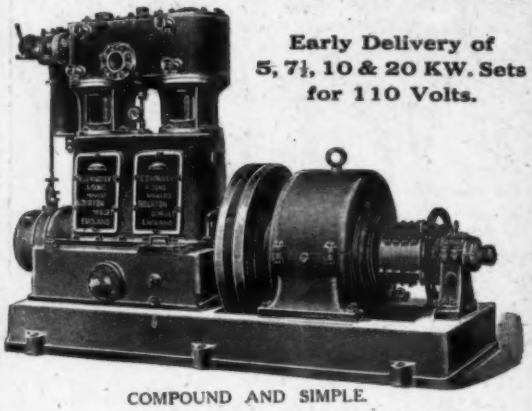

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THE

ELECTRICAL REVIEW.

VOL. LXXXVIII. APRIL 29, 1921. No. 2,266.

ELECTRICAL REVIEW.

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INDUSTRY AND WAGES.

IT seems that the Government has had under consideration a suggestion for a systematic inquiry to be made regarding industrial unrest. There was such an inquiry held during the war, as our readers will well remember. The country was divided up into districts, lightning investigations of causes of disaffection were made, the pulse of the industrial community was felt, and the Government found out many things that it wanted to know at a time when it was imperative for all our industrial resources to be employed in bringing the war to a successful issue. We observe that the Premier thinks that there *may be* a good deal to be said for repeating that experiment, and he hints that employers and employed might unite in making the investigation, thereby, as on the former occasion, assisting the Government in finding out really what is happening in the industrial world. We observe that one member of Parliament would like to include within the compass of such an inquiry the question of an equitable rate of wages, not only for one trade, but for the whole trade of the country. We are not surprised, however, to find that the Premier deprecates so wide an inquiry, and detects therein a source of great danger. Profiting, we suppose, by the experience of the Government in its unfortunate bungling of wage questions when it was controlling the production of munitions of war, he adds that questions of wages are much better settled between employers and workmen.

With regard to the proposed new inquiry, we fear that little good can be expected to result from it. It can hardly be said that the Government is in need of information as to the causes of industrial unrest, though it may be that the members of the community who have to vote at election times would be better able to judge what influences are really at work amongst us if the whole of the facts could be suitably reviewed. There is a dangerous element working for revolutionary ends, and recent utterances of a delegate of the Electrical Trades Union (London) cannot be overlooked; but we believe that the great mass of the people of the United Kingdom want to carry on their industrial and family life free from such disturbing elements. Yet they are most of them concerned about wages and probable reductions therein. They care little about inquiries respecting the causes of industrial unrest, and through their organisations they are strong enough to negotiate respecting wages. It is, as the Premier says, far better for employers and workmen to settle such matters between them. What we are waiting for is the growth of a sincere spirit of inquiry and compromise between employers and employed in each separate trade. Surely it has become plain to nearly everybody by now that if wages do not go down or, alternatively, production increase, we shall lose more and more of our trade, because our prices will continue to be non-competitive. At present, in some trades, increased production cannot be secured because there is not the demand; many selling prices have got to fall before the demand will return; yet unless we are to do business on uneconomic terms, selling costs can only fall as costs of manufacture, including wages, go down. Organised workmen may struggle to defeat their employers, and may succeed in wrecking the industries out of which they have hitherto gained their livelihood; but there will always be the economic force to fight when the employer is done with. Both sides have to reckon with it—it is always there, imperative in its laws and inevitable in its consequences. To kick against the pricks is to court discomfort, and to run one's head against a wall is not to damage the latter.

Mr. J. Annan Bryce, the chairman of the Metropolitan-Vickers Electrical Co., in the course of the speech which is reported in our "City Notes" to-day, referred to the growing human sympathy of the employers and a desire among them to maintain the improved standard of living promoted during the war, but he also showed that unless Britain could reduce its costs by an increase in output and greater efficiency and economy in every direction, the outlook for exports, upon which hitherto the prosperity of the country had principally depended, was dark. He showed also that the prophecy that when the working day was shortened the output would be maintained or increased, had not been fulfilled; in fact the output per man fell immensely and the cost increased.

How can we deal with so serious and so complex a situation? Is there no alternative to fighting things out? Must we repeat in other industries the process of ruination that is proceeding in connection with the coal trade? Maintain high wages and an industry may perish in consequence. Indulge in a struggle, shut down the works, suffer privation to secure a few shillings a week less reduction when work is resumed, but drop a few thousand more workmen into the sea of unemployment in the process—does such a course commend itself to anybody having the best interests of the community at heart?

Conferences are being held this week with regard to wages in the engineering trade, and we trust that conciliatory influences will get to work on both sides. The wage reduction proposals in this great department of industry are, it is said, being strongly opposed. It seems that the employers have suggested a reduction of 6s. per week on time rates and 15 per cent. on piece-work rates and the abolition of certain bonuses. During the past five or six years when labour in this and many other trades has put forward its demands for advances it has often asked double what it expected to get. Negotiation, strained relations, general discontent and poor output, and finally compromise—these were the different stages of the proceedings. It will be deplorable, now that reductions are being required in order that our industries may survive, if we are going to repeat the same irritating and nerve-wracking procedure. Why not short-circuit the whole business? Mr. W. O. Smith, chairman of the B.E.A.M.A., in the speech that we recently reported, referred to suggestions for wage reductions which originated from the employés' side as one of the most promising signs of the moment. The trade danger signals have not been ignored or misread. If this attitude were to develop in the interest of the community as a whole, and if employers were to agree not to ask for too sweeping reductions all at once, there would be an approach to the spirit of goodwill in which such matters ought to be settled.

We want no battles with victory to one side or the other, leaving smarts which will revive the struggles at a later stage. We want a spirit of comradeship and co-operation which will recognise that both sides are human—the war has not developed a new divinity in either.

The Electricity Districts.

The announcement made in our last issue with regard to the constitution of the Mersey and West Lancashire Electricity District, together with that which we publish to-day regarding the North Wales and Chester Electricity District, shows that the Electricity Commissioners have lost no time in arriving at their conclusions, and they are to be congratulated not only on their promptitude—which, for a Government department, is unexampled—but also on their firm grasp of the situation and their courageous decision, especially in the latter case, to follow the course which unquestionably serves the public interests most efficiently.

Their solution of the problem presented by the cleavage of opinion of the local authorities on either side of the Mersey is decidedly ingenious; a Joint Electricity Authority will be formed for the whole district, but the Wirral Peninsula will be temporarily partitioned off under the control of a separate Committee, thus becoming an "area" within a "district." What degree of authority will attach to the Wirral Committee remains to be seen; the local authorities concerned have gained their end—separation from the main scheme—and it will be for them to demonstrate the wisdom of that course by their subsequent procedure. Doubtless they will act as an Advisory Committee whose advice will be followed by the Joint Authority, in which alone, we take it, will be vested executive powers. The Mersey Power Company also receives a valuable concession, in that it will be (or, as the Commissioners put it, "may be") empowered to extend its operations into neighbouring districts. Both the Wirral Committee and the Power Company will be separately represented on the Joint Electricity Authority. This fact indicates that the Wirral Committee will not be one of the "committees of the authority" to which, under Section 6 (2) of the 1919 Act, the authority may delegate its powers or duties; it will be a body specially created to meet the position. It will be observed that the Commissioners intend to confer financial powers on the Committee, if the passing of the new Bill enables them to do so; and that a further inquiry is necessary before the order can be put into force.

Turning to the North Wales and Chester scheme, we find that the Commissioners have here made a clean cut; the interesting proposals put forward by the Chester Corporation have been swept away *en bloc*, for both technical and financial reasons, and the Commissioners have accepted those of the North Wales Power Company in their entirety. The fact that the municipal scheme failed to secure adequate public support bears out what we have said on previous occasions with regard to the financing of such projects. The local authorities are willing to formulate engineering schemes—through the medium of their engineers—and to support them with lip-service; but when the hat goes round they look the other way. As we have pointed out, if they wish to own and control the supply and distribution of electricity, they must be prepared to foot the bill. This point was strongly emphasised at the I.M.E.A. Convention last year. If they cannot do this, the matter must necessarily be left to private enterprise—for the supply must be provided by someone; and private enterprise will not come in unless it is assured of an adequate reward.

In the case under consideration, the Commissioners have realised that by entrusting the Power Company with the whole undertaking, on the lines advanced at the inquiry, they will secure the development of the water-power resources of North Wales on an economic basis, thus reducing the consumption of coal, and providing an ample supply of electricity for the whole area, and will at the same time solve the financial problem completely. A Joint Electricity Authority will be formed to exercise general supervision over the district, encourage the development of electricity supply, and advise the Commissioners. This is precisely the system which we have advocated; it may not be palatable to the local authorities, but we are convinced that it is by far the wisest solution of the problem, and the one which is most directly conducive to the welfare of the district. Further statutory powers will have to be obtained by the Company, but will involve no charge on the public purse, and being supported by the Electricity Commissioners, should be readily obtainable.

Now as to Yorkshire—but the inquiry has not yet been held; we will wait and see.

The E.T.B.I.

The meeting of the Electrical Trades' Benevolent Institution on Monday disclosed a heavy decrease in subscriptions and donations, except those received in connection with the annual festival—the total being only £656, as compared with £1,679. It is well known that retrenchment is apt to commence with the cessation of subscriptions to charitable institutions, but it is not right that this should happen; it is just when the times press retrench-

ment on the notice of the well-to-do that their poorer brethren stand most in need of help, and the stream of benevolence ought to flow in spate. It does not say much for our brotherly love that the comparatively small sums devoted to its service are readily cut off, whilst the vastly larger outlay on personal luxuries, amusements, &c., is maintained to the last moment. Can we not realise that it is a duty, as it should be a pleasure, to take care of our less fortunate comrades?

If we will not do so in our life-time, at any rate let us make some provision to that end out of the material possessions which we cannot take away with us. A kindred institution in one year received more by way of legacies than the total amount of the invested funds of the E.T.B.I. A form of bequest will be found on the back of the annual report of the Institution. Use it!

Financial Problems of Small Companies.

We have many times referred to the serious financial post-war position in which the majority of small electricity supply companies find themselves. Whereas before the war small companies, by very careful management, could be made to pay satisfactorily, post-war conditions have conspired to press them into a very awkward corner. The present restricted prices of supply, even though these be 10d. or 1s., will often not bring in sufficient revenue to meet adequately the increasing costs of supply; and this entails the obvious consequence that investors fight shy of putting in more capital. The case of the small companies was very clearly, not to say eloquently, pleaded by Mr. P. D. Tuckett last week when speaking at the annual meeting of the Urban Company, which includes a large number of typical cases of small undertakings. By an especial irony, many of these undertakings, as Mr. Tuckett pointed out, are precluded from enjoying a general increase in maximum charge under Section 32, and have to content themselves with relief under the Statutory Increase of Charges Act, which confessedly is inadequate and cannot properly meet the cases at all. The Joint Electricity Authority schemes give very scant promise of any benefit. In the first place, the majority of small undertakings are more or less out of the run of big towns, and in many cases in positions where a bulk supply cannot reach them for many a year to come. Moreover, the fact that undertakings in a District would have to subscribe to the administrative expenses of the Joint Authority, and, if they took a bulk supply, be responsible for making up deficits, makes poor, small companies feel chilly at the prospect. Again, there is the possibility that the Joint Authority itself might pick up any plum on the fringe or compete in some such way. Altogether there is no doubt that small companies must be treated as a case by themselves. The most pressing need under the existing conditions, as Mr. Tuckett pointed out, is for a wide latitude to be allowed over prices. The legal disabilities of companies which cannot apply under Section 32 must be removed, and the period of revision of prices must be much reduced from the present term of five years. Some clauses towards this end are embodied in the Electricity Supply Bill now before the House of Commons. But the strong opposition evoked by the Joint Authority finance part of the Bill makes its passage anything but a certainty. In case of its rejection, the best course would be for all the small companies labouring under these disabilities jointly to promote a Bill solely dealing with this point, which, as it would be a measure simply to regularise anomalous cases, should practically be sure of the support of the Electricity Commissioners. This would help to some extent, and in other ways the Commissioners might relax, as far as lies in their power (and there is a new legislative latitude in the 1919 Act), restrictions which might in one or another case stand in the way of development; in particular, an extension of tenure is almost indispensable if fresh capital is to be attracted into the business. Curiously, in respect of price, these statutory companies suddenly find themselves at a great disadvantage in comparison with the non-statutory ones, which are unrestricted as to price. There certainly ought not to be a premium upon being unauthorised. Again, in determining increased charges, the financial advisers of the Commissioners might well regard small companies as being on a special footing.

The mere fact that they may for the moment be paying a dividend of 5 or 6 or 7 per cent. ought not to weigh as in the case of big companies. The absolute revenue of a small company is so little in total that it only requires a breakdown or an all-round rise in wages and salaries for the dividend to be wiped out altogether. The prices allowed by the Commissioners should be fixed not only with regard to the profit at the moment, but also with due consideration of the precarious state of the financial side of the undertaking. As things are, a small company cannot raise further capital until it pays a satisfactory dividend—but if it does so, then down comes the possible increase in maximum price. In a word, small companies must be assisted to pay a good dividend, otherwise the public will suffer sooner or later—to say nothing about justice to the original shareholders. If there is one case more than another where the Electricity Commissioners should regard themselves as acting *in loco parentis* it is the case of small companies. If only these and similar anomalies can be put right there is no reason why small companies should not get on their feet again and achieve general success.

Canadian Trade.

Elsewhere we print an account of the mode of procedure of the Approval Laboratory of the Hydro-Electric Power Commission of Ontario in respect of the testing and approval of electrical installation materials and apparatus. Those of our readers who were our readers before the war will remember that in those far-off days we did our best to induce British manufacturers to take an interest in the great market open to them in the Dominion, and that this question of approval was one of the most pressing problems awaiting solution. At that time the Underwriters' Laboratories, Inc., of Chicago, carried out the tests, and the National Board of Fire Underwriters laid down the law for the whole of North America; to meet the needs of British firms, in 1913 Messrs. Heap and Digby were appointed engineers in Great Britain to the Underwriters' Laboratories, but that arrangement has lapsed. Evidently the Hydro-Electric Commission felt the urgent necessity of setting up a testing department of its own, of which we are now able to give an account. We commend the matter to the notice of British manufacturers who wish to sell electrical accessories in the Province of Ontario.

But while this arrangement liberates our manufacturers to some extent from the control of an alien institution (against which we have not a word to say, but whose autocratic control was always somewhat distasteful to us), it does not really meet our needs. The only way to do that is to set up a British National Proving House, whose label shall be a guarantee of the quality of British goods throughout the world. The case for the Proving House has been debated in our columns, at the Institution of Electrical Engineers, at the Councils of the B.E.A.M.A., and elsewhere; the Board of Trade supports it, the National Physical Laboratory will co-operate with it—in fact, it is unanimously called for—yet nothing tangible has been done. Only a few weeks ago, at the annual dinner of the I.E.E., Sir Frank Heath, secretary of the Department of Scientific and Industrial Research, stated that we should soon have a National Proving House. It is to be regretted that the veil of silence is so persistently drawn over the progress of the scheme. It is high time that the industry, which has waited so long for a most necessary aid to its functions, should at least be told how much longer it will have to curb its impatience.

D

MONTHLY GENERATING STATION COSTS.

By "INTERESTED."

In recording accurate costs, municipal electricity supply stations have many difficulties to overcome, not the least of which is payment made direct by the accountant's department and not actually passing through the books at the works. A proper system arranges for every account to bear the initials or signature of the engineer before being passed for payment. But, even with the best intentions in that direction, mistakes do occur when accounts are presented to the Council for payment without cognisance of the works clerical staff, the first intimation being the appearance of such amounts in the Council agenda. This refers equally to capital as well as revenue accounts. Particularly when has satisfactorily passed a three months' trial in a station where most of the actual financial work is undertaken from the town hall.

The illustration shows a deep pattern book ruled with a number of cash columns. Headings are written in as required. This shows a fair saving in the cost when ordering the book, and the writing does not occupy much time at the end of each month. Also this method allows for alterations being made from time to time when necessary in the arrangement of headings.

Of the side headings the first is works costs. Figures are transferred from the weekly cost book, a description of

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	Petty Cash and Postage																				
	Sundry a/cs :—																				

RECEIPTS

	June, 1920		April	May	Total 3 months	Corresponding Qr. last year: June	Corresponding Qr. last year: 3 mths
Private Consumers							
Public Lighting							
Meter Rentals							
Motor & Trans. Rentals							
Minimum Charges							
Stand-by Charges							
Hire a/c Lanterns							
,, Radiators							
,, Fans							
,, Irons							
,, Cooking							
Miscellaneous Receipts							
Totals							

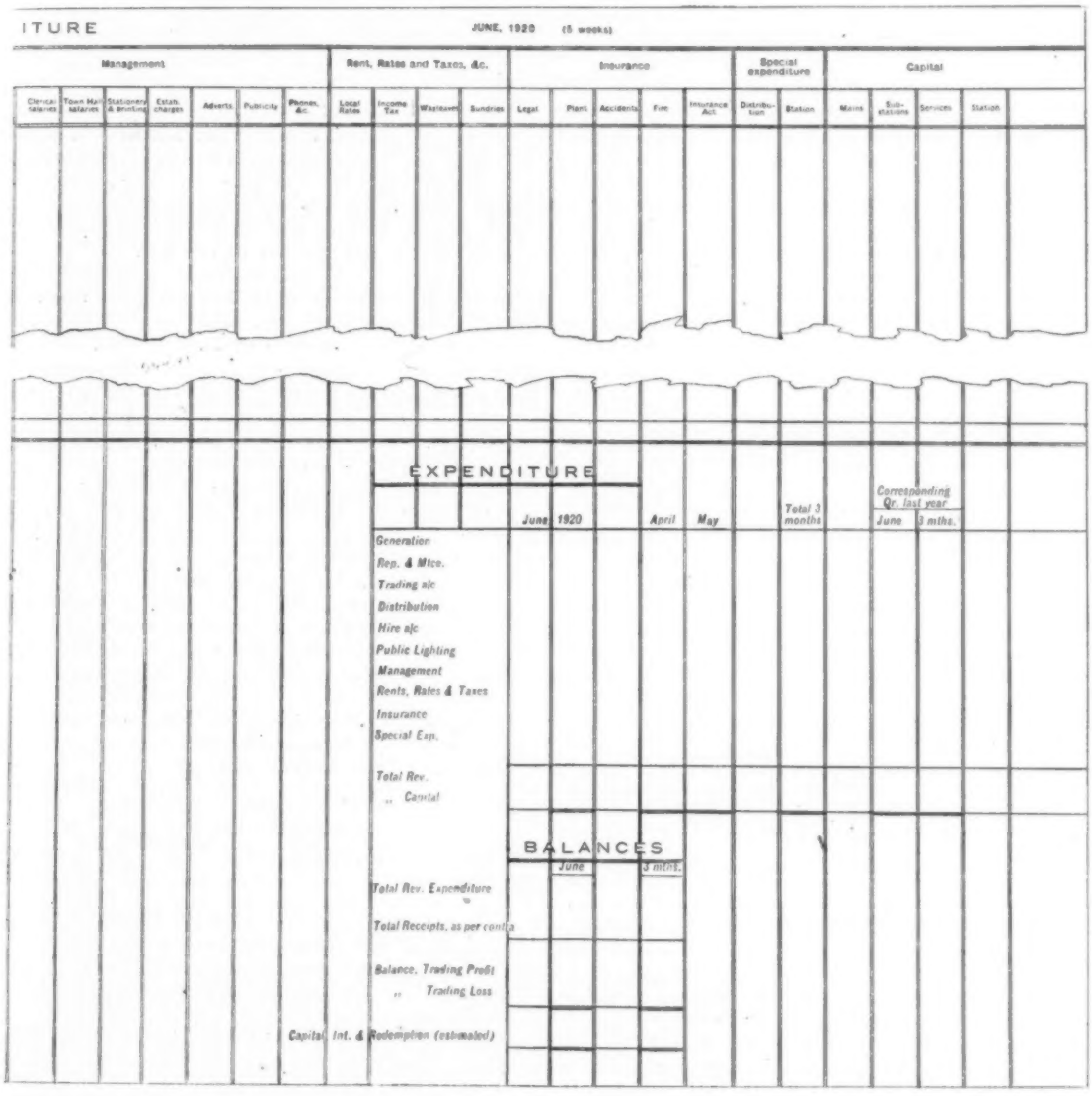
extensions are in progress, the borough surveyor may put forward certain certificates for payment from the funds of the electricity department, and a common practice in some districts is for rates and taxes to be passed by a Committee other than the Electricity Committee.

During the times of ever-increasing charges, it is imperative that complete detailed costs be presented at least monthly, and an essential point is that no item which has been paid direct in the above-mentioned manner should be omitted. Herewith is an illustrative description of a method of recording supply-station costs each month which which was recently published in the columns of the Electrical Review. The second is standing charges. These are proportioned from the sums shown in annual estimates or from the previous year's accounts, and include such items as rent, rates, taxes, insurance, engineers', and proportion of Town Hall legal and financial staffs' salaries, which are usually charged to the electricity department, likewise certain printing and stationery used at the Town Hall and charged against the department. Any adjustment, such as the unlikely reduction in rates and taxes, is made in the last month of the year, but for all practical

purposes the sums thus proportioned from previous years' accounts and current year's estimates are as accurate as it is possible to obtain the figures under the circumstances. In dealing with most of these items it is sufficient to take one-twelfth of each sum for the month, but in a few cases a better plan is to proportion the monthly sums nearer to the relative figure received for the sale of energy, which, of course, varies from month to month. However, that is a matter for individual opinions—which sometimes differ.

The third of the side headings represents petty cash and postage duly apportioned to the various sections. The remaining space of the top half of the book is utilised for sundry accounts such as coal cartage, repairs to plant, buildings, advertisements, &c. These entries are made at the time accounts are passed for payment, and the space allows for additions at any time for those accounts mentioned above, which are sometimes paid direct by the accountant without first being presented to the engineer for passing.

The lower half of the pattern is reserved for an estimate



of revenue received during the month, and for a comparative summary of both income and expenditure. By making proportional adjustments in the previous year's figures for revenue received compared with present increase or decrease of units output to mains, it is possible to arrive at a fairly close estimate of the actual revenue due for the month for inclusion in the statement just mentioned.

Figures presented in this form illustrate clearly during which months of the year profit is made, and are useful as arguments in favour of quoting low prices for long-hour consumers.

ON REVIVING EXHAUSTED DRY BATTERIES.

By "VOLTMAN."

It has always seemed to the writer that the discarding of the average dry cell when "dead" is an outstanding piece of wasteful practice. On the other hand, the wet Leclanché cell, with its renewable zinc rod and almost inexhaustible porous pot, is a much more economical proposition. Out of a dry cell one may get back only 25 per cent. of the capital value represented in it, whereas from a wet cell as much as 75 per cent. is probably obtainable. In the former case one has to scrap a large piece of sheet zinc, a sound carbon rod, and a lot of chemical material which, as experiments prove, is not so worthless as it may appear. The idea of a rechargeable dry cell is an old one—that is, rechargeable on the accumulator principle, though no one appears to have made it commercially practicable; nevertheless the writer has found that some cells, notably the Hellesen and Siemens, take quite a good and useful recharge if connected up through one or two lamps passing from .5 to .75 amp. for a period of from eight to ten hours. The carbon pole of the cell should be connected to the positive of the circuit. The effect is curious and interesting as, up to a point, the dry cell behaves like a lead accumulator. Immediately after charging, each cell will show a super-voltage up to 1.75 V per cell. This is probably

due to the presence of nascent oxygen and hydrogen in the cell, and when these gases combine the extra voltage disappears, but the voltage will still remain somewhere about normal for a new cell, and the internal resistance is beneficially reduced. Furthermore, the active material, depolariser, &c., in the cell would appear to be restored by electrolytic action in a way that renders it capable of doing more work. Certainly, the results seem to show that it would pay to give large cells a reviving "charge-up" at intervals of a month or six weeks.

Apart from passing a current through the cells, experiments on "doping" them with an oxidising reagent have given by no means negligible results. Trials were made with some very old cells, a hole first being bored through the pitch sealing to introduce the "dope." The best results were obtained with strong solutions respectively of permanganate of potash and hydrogen peroxide, and at the same time injecting some sal-ammoniac solution. In all cases the results were beneficial, and the cells were capable of giving a useful output for many months.

The writer has in use now an example of a "doped" dry cell at least ten years old, vigorously working a house bell. Until treated it was stone dead. The cardboard cover was stripped off the zinc, and a couple of dozen holes were bored with a gimlet through the shell—a very easy matter. It was then placed in a household jam jar along with the doping solution, and some sal-ammoniac. It now forms as efficient a "wet" cell as one could wish for.

[It has been said that the "charging" of Leclanché cells is a dangerous process, owing to the possibility of the formation of highly explosive compounds. The opinions of chemical experts on this point would be welcome; it would be interesting to know whether such action had actually been observed.—Eds.]

THE RIBADELAGO HYDRO-ELECTRIC SCHEME.

By E. SCOTT RIVETT.

In view of the growing interest evinced by British engineers and manufacturers in hydro-electric developments, I think I am justified in asking for more publicity for the following figures than they received in their Spanish form. Further, at the present time there is a lack of available data referring to the capital costs of water-power plant, and while I do not suggest that 10,000-kW hydraulic schemes are likely to be common objects of the English countryside—the seaside is another matter—I am hopeful that British engineers in Indian and Colonial fields will find this rough translation of Senor Oliver's report of more than passing interest and of some usefulness.

Senor B. Oliver y Román, a Spanish civil engineer, has recently published a report and estimate on a hydro-electric project on the river Tera in the Province of Zamora, in N.W. Spain. He takes us very fully into his confidence in the preparation of the estimate, and I have therefore given that part in some detail, but I have omitted a good deal of his description of the surrounding country which is depicted at great length and with true patriotic zeal.

The demand for electricity comes from the district of Valladolid, which at the present time is inadequately supplied. Also, the district of Ponferrada is crying aloud for power for the transportation of its coal and iron, and for use in smelters. There is also a likelihood of electrochemical industries being established. In view of this demand, Senor Oliver was commissioned to report on the utilisation of the Ribadelago Falls on the river Tera, among the mountains known as the Sierra Cabrera and Sierra Segundera.

At the commencement of his labours Senor Oliver met with difficulties. "The determination of the flow of the river Tera cannot be based upon direct readings, because none have been taken. This is not surprising, for the district in question lies at a very high elevation, suffers very severe winters, and is absolutely uninhabited." He began to have readings taken without delay, but as an immediate basis for his calculations he applied the results obtained in gauging stations situated in other river valleys under analogous conditions. He arrived at the following conclusions:—

1. The annual average flow of the river Tera at the point chosen is equivalent to 50 litres per second per kilometre of the valley.

2. The variations of this flow during the year are insignificant, and can be neutralised, if desired, by making use of some small lakes in the neighbourhood as storage pools.

The rainfall figures taken for many years past in an adjacent valley gave an equivalent of 45 litres per second, and as the catchment area of the Tera valley is 50 sq. kilometres, Senor Oliver felt himself justified in asking the Government for a concession of 2,000 litres per second. This has been granted. The working head at the power house was calculated at 575 metres (1,887 feet), which, with a flow of 2,000 litres per second (70.62 cusecs), will develop 12,700 h.p.

Headworks.—The only headworks necessary consist of some slight clearing of the channel and a small dam, to be placed at a point just below the confluence of the Tera with a small stream called the Lacillo, at an altitude of 1,650 metres (5,410 ft.) above sea level. The maximum height of this dam will be 10 ft. and its length 90 ft. The cost of the headworks is estimated at 27,010 pesetas (£1,080, at par), use being made of the granite which abounds on the site.

Canal and Tunnel.—The site of the power house is about four miles from the headworks, and the water will be conveyed by a canal having an inclination of 1 in 2,000, and opening out into a storage bay at the power house end. Owing to the extremely rough nature of the ground, only about 530 metres of the canal will be open to the sky, the remainder (5,850 metres) being in tunnel. On this point Senor Oliver naïvely remarks, "The difficulties of boring a tunnel through this granite mass are simply due to the hardness and compactness of the rock." The open canal has to be roofed in places as a precaution against rock-falls. The estimate for the open canal is as follows:—

	Pesetas	£
1,000 metres cube of excavation in hard rock at 5 pesetas per metre cube	5,000	200
150 metres cube hydraulic concrete at 40 pesetas per metre cube	6,000	240
Roofing, &c.	2,000	80
	Pesetas 13,000	£520

The cost of boring the tunnel and facing with hydraulic concrete is estimated at 150 pesetas (£6) per linear metre, giving a total of 5,850 × £6 = £35,100 for the tunnel alone.

Pipe-line.—With regard to the pipe line Senor Oliver studied three methods:—

1. Two steel pipes each conveying 1,000 litres per second.

2. One steel pipe only, carrying 2,000 litres per second.

3. One circular tunnel of 1 metre diameter, bored through hard granite rock.

He decides on the tunnel method because of the higher cost of steel pipe, and on account of the ruggedness of the ground. (Personally, I think Senor Oliver's profession of civil engineer influenced his decision.)

This tunnel pipe line will be first bored at a diameter of 1.6 metres and then faced with hydraulic cement to

give a diameter of 1 metre. The cost is estimated at 125 pesetas (£5) per linear metre (£2 10s. for boring, and £2 10s. for facing).

	Pesetas	£
2,400 linear metres of tunnel at 125 pesetas per metre	300,000	12,000
Auxiliaries and accessories	60,000	2,400
Steel-plate pipe for distribution of water within the power-house	40,000	1,600
Pesetas	400,000	£16,000

Power House Building.—The site of the power house has been chosen on the north shore of lake Sanabria, where there is a suitable foundation. The altitude is such that the turbine shafts will be 1,030 metres (3,380 feet) above sea level. In estimating the cost of the power house building Senor Oliver says: "As we are here concerned with a simple and easily constructed building, and as, further, there is abundance of good stone close at hand, we are justified in adopting the figure of 15 pesetas per kW installed, including in this the cost of an overhead crane, and also the tail race channel, the last being a very insignificant item." As the plant will consist of three sets of 4,700 kW each (one set always to be held in reserve), the estimate for the power house building will be $4,700 \times 3 \times 15 = 211,500$ pesetas = £8,460.

Turbines, &c.—Each of the three turbines installed will be of 6,350 h.p. Figures furnished by "one of the principal manufacturers" of water turbines in Europe" (Senor Oliver does not give the name of this firm, which is evidently not Spanish), form the basis of the following estimate:—

	Pesetas	£
One turbine	115,000	4,600
One "Universal" governor	18,000	720
One speed-regulator	1,500	60
Shafting	1,500	60
One main valve	23,000	920
Anchoring-gear for pipes, &c.	3,000	120
Pressure gauge and speed indicator	1,000	40
Foundation-plates, &c.	5,000	200
Packing cases	1,500	60
Freight charge to port of entry and Customs dues	10,000	400
Rail and road charges in Spain (30 tons)	10,000	400
Erection and testing	10,000	400
Pesetas	199,500	£7,980

For the three prime movers, installed and ready to run, $3 \times £8,000 = £24,000$.

Electrical Plant.—Senor Oliver decided upon the following characteristics of the alternators and step-up transformers, but does not give the reasons for his decision.

Alternators.		Transformers.	
Capacity	4,700 kW.	Capacity	4,700 kW.
Speed	500 r.p.m.	Voltage ratio	6,000/65,000
Frequency	50 cycles		
Voltage	6,000 volts		

In estimating for this plant he says: "At the present time it is very difficult to form an estimate for this class of plant, as everyone knows. I have, therefore, adopted the following figures, furnished me by well-known electrical engineers, as a basis for the price per kW in which all costs are included":—

	Pesetas	£
Alternators, complete with auxiliary apparatus	60	2.4
Step-up transformers (in oil)	25	1.0
Measuring and protective apparatus	10	.4
Auxiliary services	3	.12
Freight charges	5	.2
Testing	5	.2
Various	5	.2

As each set is of 4,700 kW, and one is to be held in reserve, the estimate for the electrical plant installed within the power house is as follows:—

	Pesetas	£
Three alternators of 4,700 kW. each	846,000	33,840
Three step-up transformers	352,500	14,100
Measuring and protective apparatus	94,000	3,760
Auxiliary services	28,200	1,128
Freight	70,500	2,820
Testing	70,500	2,820
Various	70,500	2,820
Pesetas	1,532,200	£61,288

Transmission Lines.—The energy generated will be transmitted a distance of 130 kilometres (81 miles), and the same lines carrying the 9,000 kW developed at Ribadelago must also transmit a further 10,000 kW developed at Cobreros Falls, a plant to be situated in the Sierra Segundera. The line voltage will be 65,000, and power will be distributed from four sub-stations by secondary networks at a voltage of 8,000 to 10,000 V. The following figures form the basis for the e.h.p. section of the estimate:—

	Pesetas	£
Steel lattice-work poles, each	1,500	60
Copper, per kilogramme	4	0.16
Insulators, each	50	2
Earth wire, per kilometre	400	16
Telephone lines, per kilometre	750	30
700 steel lattice-work poles at 1,500 ptas	1,050,000	42,000
200 tons (metric) copper at 4,000 ptas	800,000	32,000
5,000 insulators at 50 ptas	250,000	10,000
Earth wire	50,000	2,000
Telephone lines	100,000	4,000
Switch and protective gear	50,000	2,000
Erection and testing	50,000	2,000
Special poles	50,000	2,000
Pesetas	2,400,000	£96,000

Sub-stations.—Senor Oliver places the cost of the four sub-stations at 405,000 pesetas (£16,200), based on an over-all cost of 45 pesetas (£1 16s.) per kW installed.

General Estimate.

	Pesetas.	£	Pesetas.	£
I. *Headworks, dam and canal*—				
Headworks and dam on River Tera	27,010	1,080	—	—
Gate valves, screens, &c.	15,000	600	—	—
House for two families	10,000	400	—	—
Open canal	13,000	520	—	—
Canal in tunnel	877,500	35,100	—	—
Forebay and accessories	25,000	1,000	—	—
House for two families	10,000	400	—	—
Cost of land, &c.	20,000	800	—	—
			997,510	39,900
II. *Pipe line*	—	—	400,000	16,000
III. *Power-house building*	—	—	211,500	8,460
IV. *Water turbines*	—	—	600,000	21,000
V. *Electrical plant*—				
Generators and transformers	1,532,200	61,288	—	—
High-pressure transmission line	2,400,000	96,000	—	—
Sub-stations	405,000	16,200	—	—
Secondary transmission lines	400,000	16,000	—	—
			4,737,200	189,488
Total Pesetas			6,946,210	£277,848

Final Estimate.

	Pesetas.	£
General estimate, as above	7,000,000	280,000
Cost of drawing up scheme	100,000	4,000
Administration, taxes, &c.	150,000	6,000
Contingencies	500,000	20,000
Grand total	7,750,000	£310,000

Ribadelago Falls Scheme.

Cost of Power at Various Points of the System.

	h.p.	kW.	Cost in £. Per h.p.	Per kW.
Power at turbine shaft	12,700	—	6·92	—
" alternator terminals	11,940	8,800	12·06	16·52
" beginning of h.p. line	11,580	8,500	13·76	18·68
" end " "	10,770	7,900	22·04	29·92
" bus-bars in sub-stations	10,450	7,700	23·28	84·40

Note.—In working out the above figures of cost of power, Senor Oliver has evidently taken into consideration the fact that the transmission line is common to both the Ribadelago and Cobreros schemes.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Aqua" Water Heater.

A device for delivering hot or cold water by a simple movement of a tap is made by the Aqua Electric Heater Co., for which Messrs. Copus & Green, 22, Clapham Road, S.W.9, are sole agents in the London area. The construction of this appliance (fig. 1) is as follows:—

The heating element has a porcelain body through which pass 22 vertical tubes connected progressively at top and bottom to form a continuous passage over nine feet long. A coil of special non-corrosive resistance wire passes through this passage, and is connected to a switch. The switch and the hot and cold water valves are operated by a shaft. A gear on the rear end of the shaft snaps in the switch when the tap handle is turned to the right. A cam opens a valve simultaneously, and water is permitted to flow round the heating passage and out through the tap. When the handle is restored to its upright position the switch is cut out, and the cam allows a spring to reseat the inlet valve, stopping the flow of water. If the handle is turned to the left the actuating gear slides out of mesh, and does not operate the switch, but another cam opens a valve and permits cold water to flow straight through to the tap. The temperature of the hot water can be varied by altering the water inlet; this is effected by an adjustment screw. The capacity of the heating element is about 6.6 kW.

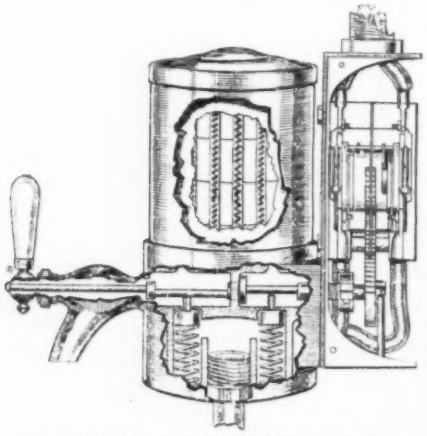


Fig. 1.—The "Aqua" Water Heater.

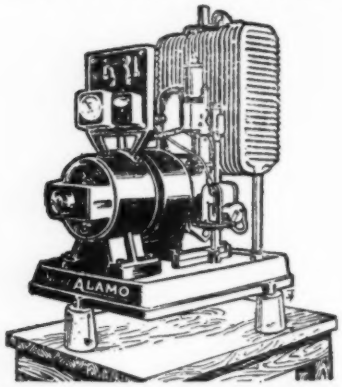


Fig. 2.—The "Silent Alamo" Generating Set.

The "Silent Alamo" Lighting Set.

The feature of the generating set which has been put on the market by Messrs. Alamo Electric, Ltd., of 36, Grosvenor Gardens, S.W.1, is its balancing and freedom from vibration; we recently saw one of these sets running under load and on light load, perched on three tumblers, with no holding-down bolts (fig. 2), and found we could balance a penny on edge on it. The engine has a rotating sleeve-valve surrounding the piston, which enables the construction to be simplified and cuts out many of the troubles met with in engines with poppet-valves. The engine and dynamo are designed as one machine, together with the radiator and controlling gear, forming a completely self-contained set, which is used in conjunction with a 100-Ah, 32-V battery, and is started and stopped by push-buttons. The output of the set is 1 kW, and it is provided with automatic devices which shut it down if the cooling water or the oil gets low, and when the battery is fully charged, whilst if the engine stops the battery is automatically disconnected.

With a set of this size, practically the whole of the lighting and small power requirements of a country house or farm could readily be met.

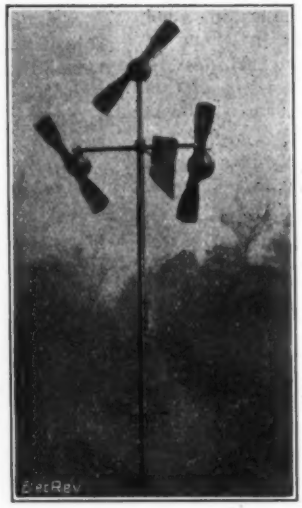


Fig. 3.—Triplex Wind Dynamos.

An "All-British" Vacuum Cleaner.

The introduction of another "All-British" electric vacuum cleaner is a step in the right direction, and the "Little Glutton" vacuum cleaner (fig. 4), which is being placed on the market by The Edison Swan Electric Co., Ltd., certainly qualifies for the "All-British" title, as it is made throughout at the Ponders End works of this company.

An outstanding feature of the cleaner is the motor, which is most rigidly built, and is of a far heavier pattern than is usually found in cleaning machines. The carcass is built up from laminated field stampings of "Stalloy" with die-cast aluminium end brackets. This carcass also carries a special automatic switch. The armature is constructed on novel lines, in that two cores are mounted on the spindle, leaving a central space one-third of its length, so that between the cores the armature windings are directly open to the surrounding air, thus providing a novel and very effective self-cooling arrangement. The armature is wound in double silk-covered copper wire, and is fitted with a commutator of 24 drawn copper bars. The spindle runs in ball bearings which are enclosed in machined housings of the same diameter as the core, and the armature can thus be inserted from either end of the carcass. The brush gear and armature can be removed from the machine without disturbing any of the connections. This motor is "universal," running equally as well on direct as on alternating current. It is made for all circuits from 25 to 100 cycles, and from 50 to 250 volts. The normal loading is 200 watts. The fan is six-bladed, and is constructed from high tensile die-cast aluminium alloy. It is of exceptional strength, and is designed to give the maximum air displacement.

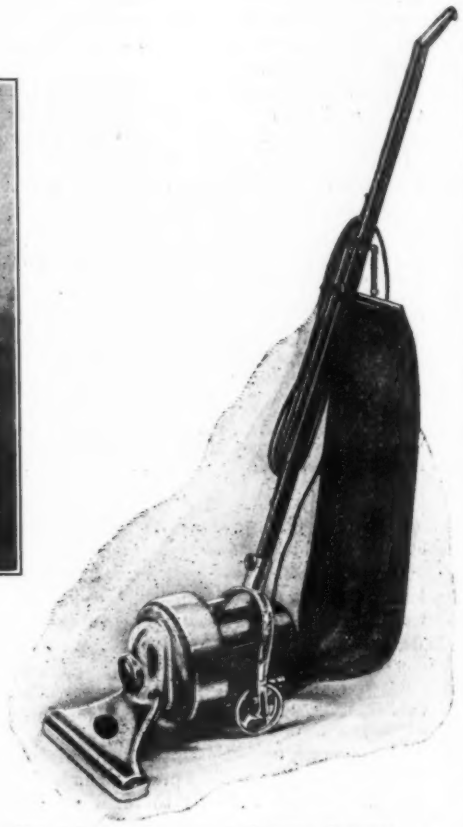


Fig. 4.—The "Little Glutton" Vacuum Cleaner.

The dust bag is made in the form of a valve in which the dust is thrown up a central passage, and is then thrown to right and left and is deposited in pockets. There is, therefore, no possibility of dust falling back into the machine, and

a clear passage is maintained when working the cleaner. The automatic switch, which is patented, is operated by the main handle of the cleaner. The normal "at rest" position of this handle is a vertical one, and is spring locked. To use the cleaner this handle is released, and is brought into the most convenient position; this automatically starts the motor. Upon returning the handle to the vertical position the motor is automatically stopped.

The machine is provided with a very complete range of accessories, including a hose length with steel extension tubes of ample diameter, and a variety of nozzles for every class of cleaning. The total weight of the cleaner is 23 lb.

Triplex Wind Dynamos.

There are undoubtedly many owners of private and small electrical installations who, though possessing the usual oil engine, dynamo, and battery, would welcome an auxiliary method of generating electrical energy provided the first cost was low and the running costs and attention required were practically nil. Large low-speed windmills have, in a few instances, been employed for driving dynamos, but their cost of installation and inability to take full advantage of the power to be derived from a gale, together with the loss of energy absorbed by the gearing necessary to run the dynamo at a high speed, are some of the reasons that have militated against their more general use. Messrs. F. A. Wilkinson & Partners, Ltd., of Hatfield, Herts., have placed on the market a system of high-speed wind dynamos for battery-charging purposes, and fig. 3, p. 544, shows one of their "Triplex" type of installation, from which it will be seen that three totally-enclosed dynamos driven by direct-coupled impellers are mounted upon a crossbar fitted with a vane and a swivel head, and are supported by a vertical tube sunk in the ground. The output from a single installation with a strong breeze is 60 watts, or 600 watt-hours for a run of 10 hours, which is about the average daily consumption of a small electric lighting installation. The output can, of course, be increased by the provision of more than one installation of wind dynamos. The apparatus is entirely automatic in its action, and has given satisfaction in actual operation.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Direction of Rotation of A.C. Motors.

In reply to the questions of "Inquirer" in your issue of March 25th, if the motor under consideration is near the alternator the direction of rotation is not a difficult job to ascertain, but if the power supply is received from a supply company, the large amount of "tracing out" engendered seldom admits of the following method being attempted. It is usually much simpler to remove the belt or, if conditions permit, to take the motor off the bedplate in the case of gear and direct drives.

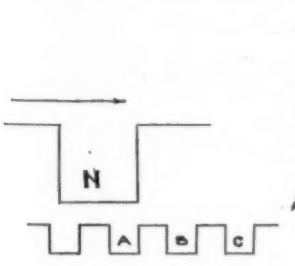


Fig. 1.

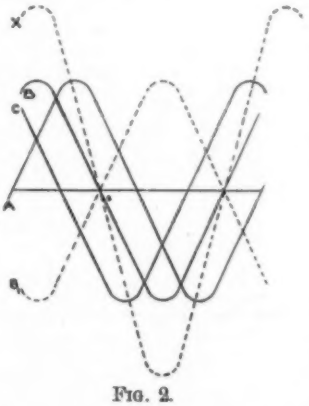


Fig. 2.

It is necessary, in finding the direction of rotation of an induction motor, to know which phase, at the motor, attains its maximum value first, which second, and which third. If we assume this to be in the order A, B, and C at the alternator, phase A, in slot A (fig. 1) first comes under the influence of the north pole, and therefore is the leading phase, followed by B and C phases, and since B phase is reversed, in both alternator and motor, the wave form in the motor is represented by A, B, C, in fig. 2. The wave form in the line is represented by A, B_1, C; X is the resultant of the waves A, B, C, and represents the magnetising wave.

If, in the motor, we represent the slots A, B, C (fig. 3) as three norths, and A_1, B_1, C_1, as three souths, since A phase is the first to reach the maximum value it will be the first to reverse its polarity, and will move the pole forward one pole phase, in this case one slot as shown in fig. 4. So that when all the phases have reversed twice and completed one period, the field will have advanced one pair of poles in the direction of the arrow (fig. 5).

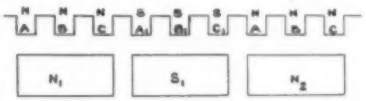


Fig. 3.

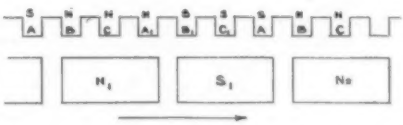


Fig. 4.

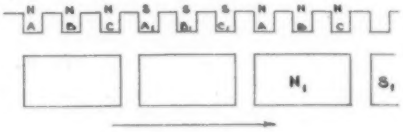


Fig. 5.

Reversing an alternator would alter the sequence of phases from A, B, C, to C, B, A, and would be similar in effect to reversing the phases A and C, and would reverse the direction of rotation.

S. S. Pilgram.

Runcorn.
April, 1921.

Gold for Notes.

In your article "Currency and Banking," in your current issue, you imply that Mr. Williams was wrong in stating that one may present a note at the Bank (of England) and demand gold. Mr. Williams, in my opinion, was quite right, for the Act of Parliament says that a Treasury note may be presented to the Bank of England, which must pay in gold on demand. Of course, what this Act gave with the right hand it took away with the left, for another clause said that gold must not be exported or melted down, thus annulling any advantage to be derived from having gold in one's possession instead of Treasury notes.

D. V. Onslow.

London.
April 21st, 1921.

[Technically, our correspondent is quite correct; as he admits, however, the free exchange of notes for gold is not now practicable.—Eds. Elec. Rev.]

Rotary Converter in Parallel with Steam Sets.

I should be pleased to hear the views of other engineers on the following.

At our generating station we have a rotary converter which runs in parallel with steam plant, generating direct current, the rotary, of course, running a.c. to d.c. On several occasions when I have taken the rotary off load (as a rule I trip her out while she is doing about 40 kW), I have noticed the steam practically fly up, this with the steam sets taking the extra load which the rotary has dropped. It does not always happen. I should be pleased to know if anyone else has experienced a like thing.

Super Tension.

April 22nd, 1921.

Wiring Ferro-concrete Factories.

If Mr. Purday were entrusted with the wiring of a ferro-concrete factory, according to his ideals heavy gauge weldless screwed tubing would be installed—that is, if there were any risk of fire. Suppose there was a fire; does he mean to say his screwed tube would emerge unscathed? I also work in an industry with considerable fire risk; I have experienced a fire, and after the fire my weldless tube and V.I.R. wire were, alas! no more. So why burn costly screwed tube and V.I.R. wire, when C.T.S. burns just as well, but costs considerably less?

I contend that C.T.S. is one of the cheapest systems of wiring, and is a sound lasting job if properly installed.

Mr. Harry Rogers will no doubt accept my statement that C.T.S. was not intended for underground work, owing to its not being mechanically protected. "Inquirer," in the first instance, stated that he thought C.T.S. "rather too unprotected." The Hurlingham Electric Co. can vouch for it in water, steam, heat, and intense cold, so now there only remains the case of someone attacking it with a hammer and chisel; C.T.S. will not stand that, neither will screwed tube.

As the Editors remark that the question under discussion is the best method of wiring ferro-concrete factories, I plump for C.T.S.; if properly used, it ranks as a good, cheap, neat, reliable job.

Of course, lots of persons are prejudiced against C.T.S., because they have never had any experience with it. If Mr. Purday has not had any, or not much, experience with C.T.S., he is not giving it the fair play, of which he appears quite enamoured.

April 18th, 1921. **Two-Phase.**

The Training of Kinema Operators.

With reference to "Electrician Operator's" letter in your publication this week, I should be greatly obliged if he could give me the name of the trade journal which, he states, runs tests and offers certificates to operators.

I quite agree with his letter, as I myself have come across two or three operators in this town who could not even wire a two-way switch and light. I may add that in a large town like this it was impossible to obtain any book on operating, but I eventually obtained one through the agency of the Caxton Publishing Co., *i.e.*, "Motion Picture Operation," and I find it a thoroughly reliable book, giving the theory and the practical side of operating; although not an operator myself, I should advise all operators to obtain one.

Bristol. **L. H. Edwards.**
April 23rd, 1921.

The Building Trades' Exhibition.

I am glad to see that you take serious notice of the unbusinesslike apathy of the electrical fraternity. It would be well if you could devote the same amount of space every week to this subject, if only for the purpose of "rubbing it in." The attitude of the Institution and the Trade Association in this matter seems to me to be unaccountable, except for the fact that knowing the electrical fraternity as I do, one can hardly be surprised at anything in this direction. Some time ago a feeble effort was made in the direction you name. I believe that an Association of the Supply Companies did start some sort of system of making a combined exhibit from various manufacturers, with a surprisingly good result. After going on for a short time, I presume the thing collapsed from sheer ennui, for I have never heard any more about it.

I can quite understand that separate exhibits, especially on the scale that is necessary, would be at present too great a strain on the financial resources of many of us to warrant continual individual exhibits, but the idea of a collective electrical exhibit is so splendid, and so simple, that it seems a great pity that the effort which was begun, and which was so successful, should have been allowed to lapse. A combined exhibit offers so many advantages. In the first place, the cost and trouble to the exhibitor is reduced to a minimum, whereas the interest to the public is enhanced many times. After all, the public that goes to an exhibition cannot or will not be bothered to go into the details of each stand or exhibit, but if a collective group of some hundreds of interesting electrical goods and appliances of every variety are brought together in one spot, then the public will be interested in the exhibit as a whole.

It is possible that the collective exhibit idea was dropped because the expense was too much for the Association that promoted it, for, if I remember rightly, no charge was made to the exhibitors—but why not make a charge? An exhibitor would be only too pleased to pay a nominal amount, and many of these amounts together would undoubtedly pay the whole expense of the exhibit. If you can do anything to "ginger up" the Association, which appears to be hibernating at the present time, you will have done a service to us all, and not least to—

London. **Gassed.**
April 25th, 1921.

[We are inclined to think that the British electrical industry wants shaking up with regard to exhibitions. Some years ago certain firms objected to exhibiting at various shows, because the profits would find their way into the pockets of private parties. Nowadays we neither organise exhibitions keeping a hold on the profits, nor do we heartily support other people's propositions; and the industry loses the benefit of the magnificent publicity that exhibitions afford. We have repeatedly advocated the holding of local electrical exhibitions; of central co-operative displays where the public can make their own choice of electrical domestic appliances; and of big exhibitions representative of the majority of the industry. Remembering many local and large-scale successes of the past, and having seen the interest evinced by the public in many trade exhibitions during the last year or so, we cannot help feeling that, in some electrical centre or other there is an inexcusable apathy which blocks the way. As announced a fortnight ago in our pages, manufacturers have not of late been prohibited from taking part in exhibitions by their B.E.A.M.A. understandings; but unhappily the lifting of the embargo does not appear to have released a flood of exhibition enterprise on the part of members, nor is there any great courting of such publicity on the part of non-members. Granted that times are trying—that uncertainty handicaps us all; but trying times increase the fertility of the soil in which electrical habits, and therefore electrical developments, grow; and however uncertain we may feel about some things, there is no doubt about the vast progress that electrical applications must make if we blow the trumpet loud and long enough.—Eds. Elec. Rev.]

Water-tube Boilers.

With reference to Mr. Cauthery's article in the Review dated April 1st, he gives a remedy for excessive density, namely, "Keep down density by sufficient blowing down." With a water-tube boiler this would be very bad practice, because the water blown out has already deposited its scale, and extra feed water has to be pumped in which contains scale-forming salts. The proper method is to allow the density to rise to the maximum of 2/32nds, and then empty the boiler completely. *Re* Mr. Porter's letter in the Review dated the 15th inst., I do not agree that the limit of 2/32nds is excessive, for the reason stated above, and with a leaky condenser, it would be highly dangerous to keep as low a density as one-quarter of 1/32nd, because of the amount of scale which would be deposited on the bottom rows of tubes. My experience of boiler insurance companies is that they cannot lay much stress on "densities," otherwise they would see that every boiler was fitted with a salinometer cock on the lowest part of the boiler, or as near the bottom row of tubes as possible. The usual method of obtaining a sample of water is through the drain cock of the water gauge mountings, at the risk of getting one's eye knocked out by the gauge glass bursting, and then not getting a correct density reading, because the density is always less in the top drum than in the bottom row of tubes. Of course "density" always indicates abnormal conditions, and in an up-to-date power station with a good water-softening plant the cause can quickly be found.

Glasgow. **A. Murray.**
April 24th, 1921.

Telephone Cables for Power Schemes.

The writer of the article on "Telephone Cables for use in Power Schemes," in your issue of April 18th, has hardly given a fair comparison between the three types of cable. Although a cable with solid impregnated paper insulation costs more than a dry-core cable, the additional cost is only about 30 per cent. greater, and not two or three times as great, as stated by the writer. Although the cable is a miniature power cable, it need not have more than half the thickness of insulation specified by the British Engineering Standards Association for low-pressure cables, and with this value will still have a higher factor of safety than cables of types (1) and (2). The transmission distances also are somewhat understated; for dry-core cable good commercial speech is possible over the following distances, even when instruments and terminal losses are allowed for.

	Dry core.	Solid impregnated.
10 lb. Conductors.	12.5 Miles.	7 Miles.
20 lb. ,,	18 ,,	10 ,,
40 lb. ,,	26 ,,	15 ,,
70 lb. ,,	37 ,,	21 ,,
100 lb. ,,	45 ,,	25 ,,

T. N. Riley, M.Sc., A.M.I.E.E.,
Cable Engineering Department,
Western Electric Co., Ltd.
London.
April 25th, 1921.

A Peculiar Phenomenon.

I have been interested in the recent correspondence regarding electrostatic phenomena, and the following experiments which I carried out some years ago may help to form the basis of a theory.

During my apprenticeship, much of my spare time was utilised in making electrical apparatus, among them a Wimshurst machine, and I found when grasping an electric lamp in my hand by the lower or pip end, that the lamp absorbed a charge of electricity when the cap was presented to the discharging rods of the machine. This continued until I received a sharp shock through a spark jumping from the cap to my thumb, and I immediately concluded that the component parts of a Leyden jar were present, and later I theorised it as follows:—

The glass of the bulb formed the insulating medium between two conductors, and my hand formed the outer coating. It is well known that electricity will pass through a vacuum, and I concluded that the charge passed into the bulb through the connecting wires to the filament, thence the particles of electricity passed through the vacuum and were distributed over the inner surface of the glass according to the position of my hand. Thus if the cap had been held near the positive electrode of the Wimshurst machine, a positive charge would pass into the inner surface of the glass, and be held there by the induced negative electricity under my hand. This would continue until the potential was great enough for the charge to jump the space between the cap and the outer coating. This happened sometimes with as much as two inches between my hand and the cap. This, of course, would only happen where there was within the bulb a vacuum or some gas which conducted electricity, and it would be immaterial whether the filament was broken or not.

It is also well known that certain rays are emitted when electricity passes through a vacuum, notably in the X-ray tube, where green rays are given off at the same time as the X-rays. If this experiment were carried out in daylight probably these green rays would appear to be grey, as men-

tioned by one of your correspondents. While charging both carbon and metal-filament lamps, I observed these rays coming from various parts within the bulb, and when it was away from the machine and the bulb turned over and over in the hand the charge was released from various parts of the inner surface of the glass, again passing through the vacuum and giving off green rays, thence it passed through the connecting wires to the cap and diffused into the atmosphere. I have often heard of machine belts becoming electrified, probably due to the slight slip on the pulley. This electricity could easily be collected into a vacuum lamp through the projecting pins on the side of the cap or even through the contact pieces on the top.

Jas. C. Lang.

Aberdeen.
April 23rd, 1921.

LEGAL.

Sevenoaks and District Electricity Co., Ltd. Reduction of Capital.

In the Chancery Division on April 19th, Mr. Justice Russell had before him the petition of this company for sanction to reduce its capital.

Mr. Gurdon, for the company, said his capital was £40,000, divided into the same number of £1 shares, only half of which had been issued. The scheme was to reduce the shares that had been issued from £1 to 10s. each. The petition was before Mr. Justice Sargant, he said, on the previous Tuesday, and he expressed his approval of it except on one point. This related to 15 shares held by three persons who were in arrears with their calls. That difficulty had now been got over by the directors having forfeited the shares, and having sold them to a purchaser for the remaining money required to make them fully paid up.

His Lordship asked counsel to mention the matter to Mr. Justice Sargant.

This Mr. Gurdon did, and his Lordship gave his sanction as asked.

Hampton & Sons, Ltd., *v.* Munroe.

In the Official Referee's Court, on April 23rd, Mr. Edward Pollock continued the hearing of an action which had occupied several days, in which Messrs. Hampton & Sons, Ltd., decorators, builders, and electrical engineers, of Pall Mall, sought to recover from Mr. G. H. Munroe and his wife the balance of an account of £7,000 for repairing, decorating, and electrically fitting their house, "Chessington Place," Chessington, near Luton. The work, it was said, included electrical fittings of an expensive character, including an electric bath.

Mr. Colam, K.C., appearing for the plaintiffs, said that the house upon which the plaintiffs had done the work was the property of Mrs. Munroe, and she called in August at plaintiffs' place in Pall Mall and said she wanted a lot of work done at her house at Chessington. The outcome of the conversation was that one or two of plaintiffs' staff visited the house with her, and estimates were from time to time subsequently prepared. There were altogether about 80 estimates, and the gross amount involved in those estimates was something over £7,000. But the whole of the work was not done because the defendants did not comply with the terms of the contract under which they undertook to pay 80 per cent. of the cost as the work proceeded. This they neglected to do, and the plaintiffs discontinued the work and claimed the full amount of the contract, less the cost of the work which had been left undone. One of the main questions to be decided, said counsel, was whether the husband or the wife was responsible. The husband was anxious to take the responsibility, asserting that he ordered the things. Then in their defence they said there was a contract for a lump sum, and that as plaintiffs had discharged themselves they could not claim anything. But there was in the contract a special note that the estimates were given subject to labour fluctuations and another to the effect that 80 per cent. of the charges should be paid as the work proceeded, and that defendants had failed to pay. If those defences failed the question would resolve itself into a matter of detail which would occupy a considerable amount of time. The plaintiffs had received £1,000 on account, but promises made of further payments had been without result. Plaintiffs were entitled to charge the increase in the amount of wages paid which came to £105. They also claimed £732 for extra work done and £132 for things which defendants would not allow them to take away from the job—materials and appliances for the work. Plaintiffs further said they were entitled to loss of profit on the items commenced but which they were not allowed to finish. The first estimate was accepted on August 12th, and men were sent down to start the work at once; but it turned out that defendants had not proper legal possession, and the men, in consequence, had to be taken away again. As a matter of fact plaintiffs did not get defendants' order to do the work until October. As to who was liable, counsel said that the estimates were prepared for Mrs. Munroe, although her husband occasionally gave directions, and although discussions took place from time to time, it was never suggested that Mrs. Munroe was not responsible.

A great deal of evidence, occupying several days, was taken, largely in relation to the ownership of the house, and the directions given by the husband or the wife for the work required.

Mr. Herbert Symons, electrical engineer employed by the plaintiff firm, gave evidence as to the electrical installation, explaining in detail all that had been done at the house. He said that the total amount of the estimate for the whole of the installation was £1,096, which included generating plant, engine, and fittings, and of that sum £149 was for the accumulator. The whole of the electrical work was not completed, and allowance had been made in the account for work which was left undone, amounting to £180 8s. The switchboard was supplied, but not connected up.

The hearing was adjourned for a fortnight in order that the Official Referee might himself take the evidence of an absent witness.

Unsuccessful Prosecution at Cape Town.

The Cape Town municipality has lately prosecuted two ratepayers (one being a town councillor) for fraudulently using electrical energy. The facts in each case were identical—the premises had been wired, but as no notice of completion had been given to the Electric Light Department the meters had not been fixed. The consumers' leads had, however, been connected to the municipality's wires without the knowledge of the department, and light had been used. In each case the magistrate decided that the municipality had not proved "fraud," and decided in favour of the defendants.

Workmen's Compensation Claim.

In the Mayor's and City of London Court, on April 18th, the case of Portugal *v.* Grayson was mentioned under the Workmen's Compensation Act in which a claim was made by Mrs. Sarah Portugal, 111, Cazenove Road, Clapton, against H. & C. Grayson, Ltd., ship repairers, 37, Gracechurch Street, E.C., to recover compensation for the death of Harry Isaac Portugal, electrician in the defendant company's service, who met his death as the result of an accident on June 22nd, 1918, at Liverpool, when he fell down the hold of the ship on which he was working. His wages had been £4 10s. a week, and he did private work as well. The claim was for £300.

Mr. Dale, counsel for the applicant, said he appeared for the mother and daughter of the deceased. The employers had paid £150 in settlement which the applicants were willing to accept. The widow was not a dependant, she having been divorced according to Jewish law, and now living in America. She had formally renounced any claim she might have had.

Judge Jackson approved of the settlement.

Hackney Borough Council Summoned.

The case referred to on p. 513 of our issue of April 22nd, came on at the North London Police Court on Tuesday. The Council, it will be remembered, failed to give supply to certain premises because the installation had been carried out by a small master man, who did the work himself and was not a member of the Trade Union. Mr. Forbes Lancaster said he would consider his judgment.

Restricted Lighting.

At Leeds Police Court, last week, Charles Landey and William Hall, shopkeepers, were charged with committing a breach of the Emergency Powers Act by using lights for display or advertisement during the period of lighting restriction consequent on the coal stoppage. In the case of Landey it was stated by the police that he had three electric lights in use and had been warned an hour before, when he had put the lights out. His defence was that he put them on again to let a customer see an article in the window. He was fined 40s., or 14 days' imprisonment. In the case of Hall, it was stated that his lights had been extinguished by order of a policeman, and that he turned them on again when the policeman had walked 50 yards away. Hall sent an assistant to the Court, but the magistrates sent him back with the message that Hall himself must appear.

Manchester Contractor Fined.

At Manchester City Police Court, Henry Hayhurst, electrical contractor, 413, Bury New Road, Higher Broughton, was fined £2 for unlawfully connecting an installation to the Corporation supply in contravention of their regulations. An inspector from the electricity department found the wires connected to the service-boxes when visiting the premises to inspect and test the installation.—*Manchester Guardian.*

BUSINESS NOTES.

Bankruptcy Proceedings.—John Jones & John Richard Jones, trading as J. Jones & Son, 7, Chapel Street, Penzance, Cornwall, electrical engineers.—The adjourned public examination of these debtors was held recently at the Town Hall, Truro. The elder partner stated that he came to Penzance about 16 years ago, and commenced business on his own two years ago. His capital then amounted to £1,900. According to the statement of affairs, the liabilities were returned at £1,040, while the assets were estimated to realise £776, leaving a deficiency of £264. The debtors attributed their failure to the illness of the senior partner, his wife and daughter, pressure by creditors, and depreciation of stock. After the junior partner had been questioned regarding the business, the examination was closed.

H. Doyle (Accessories Supply Co.), factor in electrical accessories, 56, Hardman Street, Deansgate, Manchester.—Receiving order made April 18th, on debtor's own petition.

W. Hedgecox, electrical engineer, 33, North Road, and 121, Salop Street, Wolverhampton.—Receiving order made April 20th, on debtor's own petition.

Ernest Albert Goodings, trading as Goodings & Son, The Grove, Watlington Street, Reading, motor and electrical engineer.—The public examination of this debtor was held recently at the Assize Courts, Reading. According to the statement of affairs, the gross liabilities amounted to £290, of which £289 was expected to rank for dividend, against assets £4 16s. 2d., or a deficiency of £284. Debtor stated that he commenced business without capital at "The Paddock," Staines, in 1911. The examination was adjourned.

Company Liquidations.—The Semaphore Engineering Co., Ltd., Advance Works, Jews Road, Wandsworth, London, S.W.—A meeting of the creditors of the above was held recently at the Institute of Chartered Accountants, Moorgate Street, E.C., when it was reported that the company had gone into voluntary liquidation, and Mr. H. W. McLaren had been appointed to act as the liquidator. According to the statement of affairs submitted, the liabilities amounted to £5,103. The assets were estimated to realise £4,316, from which had to be deducted £559 for preferential claims, leaving net assets of £3,758, or a deficiency of £1,345. The assets were as follows:—Cash in hand and at bank, £98; bills receivable, £88; book debts, £917, estimated to realise £430; stock at cost, £936, expected to produce £300; plant and machinery at cost, £4,484, valued at £1,200; motor van at cost, £502, expected to produce £250; and lease of premises, £2,000. The company was formed at the end of 1915 with a nominal capital of £6,000, and was engaged for a time on munition work for the Government, and made satisfactory profits. Subsequently experimental work was carried out, and there was a loss. Finally the company turned its attention to the production of all kinds of electrical goods, which necessitated the installation of special machinery. The liabilities included about £2,900 due to the directors of the company. The premises at Wandsworth were large and well equipped, and an offer of £6,000 had been received for the premises and lease. There was a contingent liability in respect of income-tax, but it was pointed out that it would probably be the subject of a set-off against a claim for the repayment of Excess Profits Duty.

A suggestion was made for the appointment of a joint liquidator, but this was not agreed to, and eventually it was decided to confirm the voluntary liquidation, with the liquidator appointed by the company.

Record Engineering Co., Ltd.—We are informed by this company, of Tutbury, Burton-on-Trent, that owing to the large demand for "Silent Record" engines, "Record" steam traps, and other goods that they manufacture, they have gone into voluntary liquidation with a view to reconstructing as a much larger company to enable them to meet their demands. We are also informed that the whole of the additional share capital is taken up by the present holders and their associates.

Dissolutions of Partnership.—Pendlebury, Sugden and Co., electrical engineers, General Street, Blackpool.—Messrs. S. Pendlebury, S. Sugden, and W. Northrop have dissolved partnership. Debts will be attended to by Messrs. Sugden and Pendlebury, who will continue the business.

Wager & Coller, electrical engineers, 108, St. Benedicts Road, Small Heath, Birmingham.—Messrs. A. J. Wager and E. W. Coller have dissolved partnership. Debts will be attended to by Mr. Wager, who will continue the business.

Trade Announcements.—The electrical engineering and contracting business, formerly carried on under the name of Guy V. Laycock, Cloth Hall Street, Huddersfield, is now incorported as a private limited company, under the title of Guy V. Laycock, Ltd., at the same address. The business is now under the management of Mr. H. P. Ripley, who for the last 15½ years has been chief of the electrical department of Messrs. Thos. Broadbent and Sons, Ltd., of Huddersfield.

Mr. M. T. Pickstone, who was for many years connected with Messrs. Bruce Peebles & Co., Edinburgh, and who has since been engaged in pneumatic engineering, has now joined the Progressive Engineering Co., Ltd., of Leicester, with a view to taking over the development of the fan side of their business.

Mr. Edward P. Prior has removed from King Street to Gibson's Buildings, Mill Street, Belfast.

The Government having given up possession of their premises at Millbank House, Messrs. I. A. Timmis & Son re-occupied there as from Monday last. Communications should therefore be addressed as follows in future:—Millbank House (2, Wood Street), Westminster Abbey, London, S.W. 1.

Catalogues and Lists.—Messrs. Ward & Goldstone, Ltd., Frederick Road, Pendleton, Manchester.—An illustrated and priced pamphlet dealing with the "Dimla" switch for reducing the intensity of automobile headlights.

Messrs. Hindle, Son & Co., Union Engineering Works, Haslingden, Lancs.—An illustrated pamphlet describing patent electric baling presses.

Messrs. Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, W.C. 2.—Six well-illustrated descriptive pamphlets:—L. 111/3, Aircraft wireless telephone transmitter, type A.D. 1; L. 126/3, Combined aircraft transmitter and receiver, type A.D. 2; L. 135/3, Aircraft receiver, type A.D. 3; L. 170, 1½-kW continuous-wave transmitter sets, types M.C. 1 and M.C.; L. 173, 3-kW continuous wave set for telegraphy; and L. 175, Marconi 6-kW continuous-wave transmitter set for telegraphy.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C. 2.—Installation Leaflet No. P. 2,463. This publication gives a number of illustrations, and an exhaustive description of a gas engine generating set installed in a large country residence.

Metropolitan-Vickers Electrical Co., Ltd., 20, Brazennose Street, Manchester.—Instruction Book 5,370/1, giving very full and illustrated details of the installation, working and care of power transformers.

Messrs. Herbert Morris, Ltd., Loughborough, Leicestershire.—An illustrated folder dealing with elevating trucks, and showing various applications.

Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C. 4.—Illustrated descriptive booklets describing the use of screened pilot cable for the Merz-Price feeder protective system, and "Kalecore" cable for automatic protective gear.

The Swift Electrical, Ltd., 6, Cork Street, Old Bond Street, W. 1.—Three postcards giving illustrations and prices of "Z" type ironclad switch and fuse-gear.

Messrs. Austin Walters & Son, Gaythorne Electric Works, Manchester.—An illustrated circular dealing with tandem resistances, dimmers, and other types of resistances, &c.

The Cambridge and Paul Instrument Co., Ltd., 45, Grosvenor Place, S.W. 1.—List No. 160—"Cambridge Unipivot Instruments for Direct Current," giving very full details and illustrations of various types of instruments, standard shunts, &c. List No. 164—"Cambridge Testing Sets," illustrating and describing portable sets, fault localisers, capacity test sets, rail band testing sets, &c.

Private Meeting.—Samuel Horace Dougherty, trading as the Mersey Electric Co., 106, Kensington, Liverpool, and 53, Warren Road, Southport.—A meeting of the creditors of the above was held last week, when a statement of affairs was presented which had been prepared by Messrs. T. Theodore Rogers, Bowler and Co., chartered accountants, 30, North John Street, Liverpool. The liabilities amounted to £1,135, while the assets were estimated to realise £633. After allowing £73 for preferential claims, the assets were estimated to realise £559, or a deficiency of £576. The assets comprised stock at cost £565; book debts, £41; estimated to produce £35; fixtures, fittings and utensils, £30; and surplus from fully-secured creditors, £3. In a circular which they have issued, the accountants state that "the two principal trade creditors were present at the meeting. These were the General Electric Co., Ltd., £226, and the General Engineering Co., Ltd., £185. . . . The preferential creditors include £60 for wages, and £13 for rent. . . . At the meeting it was found that the General Electric Co.'s claim was £48 more than was given to us by the debtor, and the liabilities therefore want increasing by this amount. . . . After full discussion at the meeting, the two principal creditors stated that they would prefer the matter dealt with in bankruptcy. We have, however, had a further interview with the debtor to-day, and he is very anxious if possible to continue the business, and is writing up to some solicitor friend in Glasgow to-night with full particulars to ask if he can come to his assistance in order that he may make an offer to his creditors. We endeavoured to get the petitioning creditors to hold their hand while this communication was going forward, but their solicitor was of opinion the petition had better go on the file at once, and that if we were able to show them that there was a prospect of an offer, then the petition should be adjourned to enable us to formulate the offer to the creditors, and if accepted, the petition could be withdrawn. We think you will agree it is in the interests of the creditors that all efforts should be made to get a fair offer, as if the case goes into bankruptcy, it can only result in a very small dividend."

Patent Application.—Mr. J. Carpentier has made application for restoration of Patent No. 19,102, of 1910, for an "Improved transmitter for transmitting telegrams composed in perforations on a band by the Baudot system."

Inquiries.—The maker's name and address are asked for in respect of the following items:—"Type H N 300" d.c. 30-kW generator, 110 volts; an electric egg tester; "Pluton" insulating material; "Perry" (or "Parry") electric pump.

Social Events.—Messrs. Rawlings Bros., Ltd., of South Kensington, held their first annual social after the war at the Kensington Town Hall on April 19th, between 300 and 400 employés and their friends were present. Mr. W. R. Rawlings, one of the joint managing directors, said that he and his brother, John Joseph, started in business in Kensington 35 years ago as general engineers, following immediately with the electrical business, and they were practically the first to start electrical contracting in Kensington. With the advent of the motor car, they started many garages in London. In 1900, in order to meet the expansion of the business, they became a limited company, and added further new departments. Two years ago they took over premises in Gloucester Road, where the head offices are now situated. The Rawlplug, which was invented by Mr. J. J. Rawlings, is manufactured by a separate company with a factory at Lewisham. Mr. W. R. Rawlings mentioned there were 23 employés now with the company who had been with them upwards of 20 years, some going back beyond 30 years. The directors marked their appreciation by presenting to each a gold compass pendant. A number of employés have invested loans amounting to £1,000, for which the company pays 7½ per cent. interest, and it is expected that the rate will be increased to 10 per cent. It was announced that Messrs. J. J. and W. R. Rawlings personally desired to commemorate the occasion by giving 700 fully-paid ordinary shares of £1 each in Rawlings Bros., Ltd., to the old employés, £100 each to the three oldest employés, and £100 each to four other employés, who were selected by ballot. A fine programme of music and song, recitals and ventriloquial vagaries contributed to the success of the gathering.

Japanese Electrical Dumping in Australia.—We quote the following interesting note from the *Melbourne Age* for February 28th :—

"The report published in these columns a few days ago indicating that an organised effort was being made by Japanese manufacturers to 'dump' goods on the Australian markets is supported by vendors of electrical fittings. It is alleged that the dumping scheme has been particularly successful in regard to electric lamp-holders, and a claim is made by Australian manufacturers of these articles that the duty should be increased from the present rate of 40 per cent. in order to defeat the move. A favourite plan adopted by the Japanese, it is stated, is to duplicate the orders for fittings, and so flood the market. As a result the holders of local manufacture, which are acknowledged to be superior to the Japanese goods, are practically unsaleable, and an industry promising employment to several hundreds of Australians may have to be abandoned, unless effective protection be afforded it. It is contended that, while Australian manufacturers have to pay 16s. a day wages, and the Japanese only 4s., the 40 per cent. duty is not an adequate protection against Oriental competition. Instances of this character have been reported frequently in the last few months, and it will be necessary for the Minister and his officers to keep a watchful eye on trade developments if the acknowledged evil of 'dumping' is to be suppressed."

South African Electrical Supplies.—The *S. A. Mining and Engineering Journal*, in its issue for April 2nd, says that trading is quite good in electrical wares, fair orders coming in from the country districts in addition to the local requirements. Prices remain unchanged. The demand for half-watt lamps continues, but stocks of these are very slow in arriving ; otherwise materials are coming to hand satisfactorily.

The Budget.—In concluding his speech on behalf of the Chancellor of the Exchequer (Sir R. Horne), Mr. Austin Chamberlain reviewed the achievements of the past two years in connection with the restoration of credit, in the following terms :—

"We have re-established Treasury control, necessarily abandoned during the war. We have ceased to borrow, we have begun to repay debt, the deficit of the first year has been converted into a surplus, and the foundations have been laid for a steady recovery when industrial disputes are laid to rest and trade can begin a new revival. Finally, we have wiped off a large part of our foreign debt, we have restored our international credit, and we have made it clear to those who doubted our capacity or our will that we can hold, and shall hold, for this country and this City their proud position as the premier financial centre of the world."

Electric Company's Offices Raided.—An official Dublin Castle report states that the offices of the Kerry Electric Supply Co., Killarney, were raided by armed men, who held up the staff and carried off three miles of electric wire, three testing instruments, a mile of flexible cord, and tools and insulating tape.

Metropolitan-Vickers in Belgium.—The Metropolitan-Vickers, Société Anonyme, with a capital of 1,000,000 fr., has been established at Brussels (54, Rue des Colonies), for the carrying out of all operations relating to the trade and industry of electrical material and machinery.

Industrial Councils.—The District Council (No. 2) for the electricity supply industry at its monthly meeting at Leeds, on April 13th, decided that the two representatives from each electricity undertaking and Trade Union in the area should be invited to the annual meeting to be held at Leeds on May 11th, when the election of the Council will take place. There are 18 candidates for the 12 seats on the employers' side of the Council.

Book Notices.—The *Journal* of the American Institute of Electrical Engineers, Vol. XL, No. 4, April, 1921. New York : The Institute.—In addition to reports of proceedings at meetings of the Institute and kindred societies, a number of valuable papers are embodied in this issue. Among these are a description of the Duquesne Light Co.'s 300,000-kW Colfax power station ; "The Frequency Problem in the Steel Industry" ; "Longitudinal and Transverse Heat Flow in Slot-wound Armature Coils," &c.

"Management." By J. Lee. Pp. viii + 126. London : Sir I. Pitman & Sons, Ltd. Price 5s. net.

"Elements of Illuminating Engineering." By A. P. Trotter. Pp. xii + 104, 63 figs. London : Sir I. Pitman & Sons, Ltd. Price 2s. 6d. net.

"The Henley Telegraph." Vol. I, No. 5, March, 1921. (32 pp.) —This number of Messrs. Henley's house organ contains the usual interesting notes, articles and verse. Mr. H. R. Kempe contributes some recollection of the founder of the firm, and Mr. J. Hall gives some information regarding deep-sea soundings for cable laying.

"Dynamo and Motor Attendants and their Machines." By Frank Broadbent, M.I.E.E. (Tenth edition.) Pp. 214 ; 107 figs. London : S. Rentell & Co., Ltd. Price 4s. 6d. net.—The preface to this edition of a well-known manual states that the chief revisions are in connection with the permissible temperature limits of dynamos and motors and the method of reversing induction motors. As a popular handbook for the use of the readers named in the title, this work would be hard to beat ; it is a mine of practical information regarding the principles and operation of the machines, their applications, their weaknesses, the troubles that arise and their remedies. It deals also with accessories such as motor starters, regulators, belts and gearing, and accumulators.

We have received from Messrs. H. K. Lewis & Co., Ltd., 136, Gower Street, and 24, Gower Place, W.C. 1, two supplementary catalogues (price 1s.) of medical and scientific works in their circulating library. The price of each book is given, and the lists cover a very wide field in the many branches of science.

Copper and Lead Prices.—Messrs. F. Smith & Co. report, April 26th :—"Copper (electrolytic) bars, sheets, wire and rods and h.c. wire, no change."

Messrs. James & Shakespeare report, April 27th :—"Copper bars (best selected), sheet, rod, no change. English pig lead, £22 5s. ; 5s. decrease."

Lead.—Messrs. James Forster & Co., reporting on April 23rd, stated :—"With trade anything like normal, the question of supplies would be serious, as, with Australian production on a very low scale, Mexican mines reported shutting down and Germany out of the running with the 50 per cent. tax, we are left with Spain as our only reliable source of supply. On the other hand, consumption in this country is anything but good. We understand that for March the sheet and pipe lead figures are just over 5,000 tons (in October last they were 50 per cent. more), and the electrical trade demand has fallen off to a similar extent."

Scottish Electrical Trades Dispute.—The Electrical Contractors' Association of Scotland states, with reference to reports to the effect that 41 firms in the Clyde area have agreed not to reduce wages, and that many of these firms belong to the Employers' Association, that no member of the Association in the Clyde area is acting contrary to the recommendations of the Association. In the Edinburgh district, it states, only three federated firms have not accepted the recommendation, and it is incorrect to state, with reference to federated firms, that nine firms in Edinburgh have signed agreements to pay the old standard rate of 2s. 3d. Several firms are fully staffed at the new rate, and, as a matter of fact, are passing applicants for work on to other firms. The number of employés working is now considerable. In Dundee and Aberdare all federated firms are conforming to the recommendations of the Association. In Dundee the employés of three firms have returned to work at the new rate of 2s. per hour, and throughout Scotland there is a distinct tendency for men to return to work at the new rate, and a considerable amount of labour has recently been obtained. On the whole throughout Scotland, it is stated, the majority of apprentices have not struck work in support of the journeymen's demands.

New French Companies.—There has been formed at Lille (70, Rue Gantois), the Société Anonyme des Accumulateurs du Nord, with a capital of 1,600,000 fr., for the manufacture and sale of accumulators and electric lamps for the mines.

The Aciéries et Usines Hydro-Electriques de la Sioule (Albert Wehrlé et Cie.), has been formed at Bellenaue Department of Allier, with a capital of 4,000,000 fr.

Under the style of Stourm et Cie., there has been established at Paris (19 bis Rue de Boulainvilliers), a company, with a capital of 275,000 fr., to carry out electrical, water, gas, and heating installations.

A Dundee Exhibition.—An interesting exhibition and demonstration of electrical labour-saving devices attracted attention last week at the premises of Messrs. Ponsford and MacHardy, Ltd., when Messrs. Simplex Conduits, Ltd., demonstrated their "Plexsim Royal" vacuum cleaner, which is up-to-date from every standpoint. Other popular exhibits were the "Thor" washing machine, the "Western Electric" sewing machine, and the domestic motor.

Australian Electrical Manufacturing: The Question of Preference.—Following upon the reference to the Sydney transformer contract in our last issue, we give below a copy of a letter written to the Sydney *Morning Herald* of February 24th by the Lord Mayor of Sydney and the chairman of the Electric Supply Committee:—

We shall be glad if you will publish the following figures, which give in detail the tender prices for electrical transformers as called for by the City Council specifications 626 and 635:—

The English Electric Co. of Australia, Ltd. (local manufacture)	£17,082
Edison Swan Electric Co. (imported)	£20,753
British General Electric Co. (imported)	£22,104
Alternative (ditto)	£21,258
Metropolitan-Vickers Electrical Co., Ltd. (imported)	£22,392
Ditto, ditto (imported)	£20,070
Alternative (imported)	£19,584
Johnson & Phillips, Ltd. (imported)	£23,813
Alternative (ditto)	£22,622
Australian General Electric Co., Ltd. (imported) ...	£24,255
Alternative (imported)	£18,390
Noyes Bros., Ltd. (imported)	£25,866
Ditto (ditto)	£25,866

The following tenders were received on January 17th, 1921, for transformers, to specification No. 635:—

General Trading Co. (local manufacture), (afterwards withdrawn)	£10,400
Noyes Bros., Ltd. (imported)	£11,440
Australian General Electric Co. (imported)	£12,372
British Electrical Engineering Co. (imported) ...	£12,997
Metropolitan-Vickers Electrical Co., Ltd. (imported)	£13,540
Alternative (imported)	£12,500
English Electric Co. of Australia, Ltd. (local manufacture)	£13,700
Johnson & Phillips, Ltd. (imported)	£13,800
Alternative (imported)	£13,100

It will be observed that in the first case the local manufacturers' price was lowest, but when a second lot of transformers were called for the importing firms lowered their prices in line with the local manufacturers' price and even below it. The lowest tender for imported machinery was sent in by the firm whose previous tender was actually highest.

There is little need to comment upon these figures. They show that the infant industry in Australia will require a little shepherding to prevent it from being crushed by concerns which think they have vested interests in the supply of such goods.

The City Council wants to buy in the cheapest market, other things being equal. But it is primarily concerned with the well-being of its citizens, and we consider that it is better to give mechanics the opportunity of earning good wages than to save even 20 per cent. on a tender and spend the money saved among the people of Australia. Our policy is to patronise and encourage Australian industry, if reasonable conditions are offering.

We are, &c.,
WM. H. LAMBERT, *Lord Mayor.*
W. HOLDSWORTH,
Chairman,
Electricity Supply Committee.

The Coal Miners' Strike.—It is reported from Rome that owing to the British miners' strike the Italian Government has curtailed the supply of coal to private manufacturers. Gas and electricity undertakings were ordered to reduce lighting last week, and the train services were to be reduced on Tuesday last.

Fines.—A number of miners were on trial at Cupar, Fife, last week, on charges connected with recent disturbances at the electric pumping station at Milton of Balgonie, when the boiler fires were drawn, and those working the pumps ordered to withdraw. The mine manager stated in evidence that the immediate damage by the stopping of the pumps was that 12 motors and machines were "drowned," and the cost averaged £350 each. It would be more than a couple of months before they got a full start. Sentences ranging from two months' to fourteen days' imprisonment were passed on the men.

At Birmingham, on the 22nd inst., Messrs. Charles Alder, Ltd., coal merchants, were fined £25 and costs for selling coal in greater quantities than one hundredweight.

Glasgow.—In common with the rest of the country, industrial establishments in the West of Scotland are hard pressed for the want of fuel. Messrs. Wm. Beardmore & Co., who employ over 3,000 men at the Parkhead Forge, state officially that they have no intention of closing down. The establishment may be compelled to slow down should the miners' strike be prolonged, but as a large portion of the works is operated by electricity supplied by the Corporation, they hope to carry on for a considerable time. Other large establishments using electricity are in the same fortunate position. Street lighting has been reduced.

North-East Coast.—From Berwick-on-Tweed to the Tees the continuance of the strike is having serious effects upon local industry. The cut in the electricity supply by 50 per cent. has meant that several of the shipyards and engineering works have had to be closed down temporarily, and a system of long week-ends has been adopted, the works shutting down on the Thursday of one week to the Tuesday of the next. The Sunderland Corporation has restricted the supply to three days a week, and the Newcastle Electric Supply Co., which serves Newcastle-on-Tyne, is also having to limit its services to its customers. The tramway services in the district have been curtailed, and at Newcastle the reduction amounts to 35 per cent. of the normal cars in use. This drastic reduction commenced on April 25th.

Lancashire.—The tramway services in many towns, including Oldham, Stalybridge, and Blackpool, are being suspended on Sundays. At Burnley cars are being run on Mondays and Saturdays only, and the Oldham Electricity Committee has circularised its consumers asking them to economise in the use of electricity.

Halifax.—The Tramway Committee cut down the tramway service practically immediately the coal shortage began in order to conserve fuel from the first. The Sunday service was suspended after the first week of the strike, and last week the Tramway Committee decided that from April 25th the week-day service should commence an hour later in the morning and cease half an hour earlier at night.

Doncaster.—It was announced last week that if the coal stoppage continued the electricity supply would probably not be maintained for more than a further three weeks, as the fuel supply would then be exhausted, which would mean the cessation of both tramway and general electricity supply. The Sunday tramway service was suspended on April 24th.

Nottingham.—The tramway service is to cease at 7.30 p.m. daily and the Sunday service has been cancelled.

Bradford.—Both electricity and gas departments can carry on for a few weeks for both power and lighting purposes.

Bolton.—The Corporation gas and electricity undertakings could probably keep going for another six weeks; electricity is chiefly used for power purposes in the engineering trade.

Huddersfield.—The public services of gas and electricity have coal stocks to serve for some time.

Wolverhampton.—The motor, electrical, and hollow-ware trades are amongst those hit severely.

London.—Drastic curtailments in electric tramway-car services are asked for by the Secretary of Mines in a letter to local authorities impressing on them the necessity of observing strictly the 50 per cent. restriction in the use of coal. Electric power for tramway-car services, it is stated, should forthwith be reduced by at least 25 per cent., and it is suggested that services should be suspended wholly or in part during the comparatively slack hours of the day. The restriction of the use of gas and electricity in hotels is being taken up with the Hotel Proprietors' Associations in London and the provinces. Considerable movements of coal took place on the 22nd inst., in order that works of vital national importance could be kept supplied. The Secretary of Mines also states that in the public interest strict observance of the fuel and lighting regulations is necessary. In a letter addressed to proprietors of hotels and boarding houses, the Secretary for Mines asks that immediate instructions be given that illumination shall be reduced to a minimum, a proportion of the bulbs being removed in the case of electricity, and that every other measure which will tend to conserve the consumption of fuel directly or indirectly shall be taken. The letter adds that it is not anticipated that further supplies of coal will be available until a considerable time after the termination of the emergency, and that gas and electricity undertakings will shortly have much difficulty in supplying their customers unless demands are materially reduced.

The successive reductions of train and boat services are seriously interfering with the ordinary course of post, state the Postmaster-General.

The London & South-Western Railway put into force on the 22nd inst. several rearrangements in services, and those on the suburban electrically-operated lines are being reduced. The London "tube" and underground railways are being opened later in the morning and closed earlier at night than usual.

Street and Public Lighting.—Mr Bridgeman, the Secretary for Mines, has issued a further direction under the Emergency Regulations, 1921, dealing with the restriction of street and other public lighting. The coal emergency directions issued at the commencement of the present emergency required local authorities to restrict such lighting as much as possible, but as this has not led to the curtailment which is considered necessary the new direction requires that, subject to police requirements, the consumption of gas and electricity for street and other public lighting shall not exceed 50 per cent. of the quantity supplied and consumed on the corresponding date last year.

West Ham.—At the Town Council meeting on Tuesday night it was reported that owing to the shortage of coal the Electricity Committee had put all consumers on half supply.

New Belgian Company.—At Antwerp has been embodied a company, the Ateliers Marckx, with a capital of 800,000 fr., for the construction and working of shipbuilding and repairing yards, and all kinds of electrical undertakings. Offices, 36, Quai Sainte Aldegonde.

The N.E.L.A. Convention.—The forty-fourth Annual Convention of the United States National Electric Light Association is to be held in Chicago from May 31st to June 3rd. The Convention headquarters is to be the Drake Hotel, and further information can be obtained from the Committee at that address.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries:—

Miller. No. 403,776. Class 6.—Dynamos for use in electric lighting sets for motor vehicles. No. 403,777. Class 8.—Fitted electric switchboards and batteries all for use in connection with the electric lighting of motor vehicles. No. 403,778. Class 13.—Metal goods including lamps for vehicles, electric fittings used in connection with the electric lighting of, and with starting sets for motor vehicles, &c. H. Miller & Co., Ltd., Monarch Works, Miller Street, Birmingham. May 5th, 1920.

Triangle and circle design. No. 412,723. Class 8.—Electric apparatus. Delta Star Electric Co., 2433, Fulton Street, Chicago, U.S.A. February 2nd, 1921.

Kingsway. No. 404,945. Class 14.—Electro-plated goods. Suckling, Ltd., Kingsway House, Albion Street, Birmingham. June 8th, 1920.

Majestic. No. 408,555. Class 18.—Electric heating radiators. Majestic Electric Development Co., 656, Howard Street, San Francisco, U.S.A. October 1st, 1920.

Eisemann Magneto Corporation (lettering and design). No. 412,419. Class 6.—Machinery of all kinds. Eisemann Magneto Corporation, 32-33rd Street, Brooklyn, N.Y., U.S.A. February 2nd, 1921.

Hotpoint. No. 376,582. Class 13.—Electric appliances for heating, cooking, ironing, and cleaning purposes. Hotpoint Electric Heating Co., Lemon Street, Ontario, Cal., U.S.A. January 23rd, 1917.

Metrovick. No. 401,999. Class 50.—Electric insulators, insulating materials, and preparations. Metropolitan-Vickers Electrical Co., Ltd., 4, Central Buildings, Westminster, S.W. March 17th, 1920.

M.V. & M.V.E.C. (lettering and design). No. 403,546. Class 50.—Electric insulators, insulating materials, and preparations. Metropolitan-Vickers Electrical Co., Ltd., 4, Central Buildings, Westminster, S.W. April 29th, 1920.

Electric Carbons: Meeting of Importers.—We read in the *Chamber of Commerce Journal* that an emergency meeting of the carbon importing members of the Electrical Importers' and Traders' Association was held recently at the Association's offices (London Chamber of Commerce) to consider what action should be taken in reference to the Government's proposal to impose a 33⅓ per cent. duty for five years on imported arc lamp carbons (under the Key Industries Schedule). A special committee was formed under the chairmanship of Mr. Charles Leven, M.I.E.E. (Electrical Engineering & Equipment Co., Ltd.), and a guarantee fund established to combat the inclusion of arc lamp carbons in the schedule referred to. A communication was reported from the Kinematograph Exhibitors' Association of Great Britain and Ireland, intimating its opposition to the Government's policy and its willingness to co-operate with the E.I.T.A. in the matter. It was resolved to develop active opposition along three lines, viz.:—

1. A deputation to the Board of Trade in conjunction with representative consumers of the goods in question.

2. Mobilisation of Parliamentary opposition.

3. Press propaganda, showing the effect which the proposed duty would have upon prices to the home consumer and the dangers attending the consequent virtual monopoly which would be conferred on a single British manufacturing group.

The secretary was instructed immediately to take all necessary steps to give effect to this policy.

Engineering Wages: Conference.—*The Times* reports that a conference between representatives of the Amalgamated Engineering Union and kindred organisations and the Engineering and National Employers' Federation was held at Broadway House, Westminster, on April 21st, Sir Allan Smith, M.P., presiding, to discuss the employers' proposals for reduction of wages. The men's case against the proposals was stated, and an adjournment for a week was agreed to. The proposals include a reduction of 6s. a week on time rates and 15 per cent. on piece-work rates, together with the abolition of the bonuses of 12½ per cent. on the earnings of time workers and 7½ per cent. on the pay of piece workers. According to our contemporary, the conference was a private one, but it is understood that it was represented on behalf of the men that the proposed reductions were not warranted, having regard to the rate of wages paid to workers in other trades which did not require equal or higher skill. It was further claimed that the rate of remuneration paid to the skilled engineers was not commensurate with the value of the engineering products to industry generally. The employers promised to take into consideration the arguments advanced for the men, and the conference was adjourned until Thursday (yesterday).

"Mr. J. T. Brownlie, chairman of the Council of the Amalgamated Engineering Union, interviewed at the close of the conference, said that the average rate of pay for skilled engineers was £4 9s. 1d., which was equivalent in money wages in 1914 to £1 18s. 3d. The effect of the employers' demands was to reduce the present average wage to £3 13s. 3d., or 21.4 per cent. below 1914."

A conference of 900 delegates of the A.E.U. was held at the Memorial Hall on Tuesday, at which the employers' proposals were considered. It is stated that there was strong opposition, firm action and resistance being advocated by some speakers. The conference was adjourned until Wednesday.

The Times further reports the holding of a conference of engineering union representatives numbering 120, at Caxton Hall, on 22nd inst. Resolutions were passed to the effect that the representatives of the organisations do not commit themselves to a joint recommendation with the employers to reduce wages, and that a further meeting be held to consider the matter. Referring to the "attack made on women's wages by the Engineering and National Employers' Federations," a resolution was passed requesting the male members of the Trade Unions to render practical help and sympathy to the women on the grounds that if the reductions were insisted upon they would reduce the position of women employed in the industry to sweating conditions, which would be a shame to our social life.

Fires.—According to the *Daily Chronicle*, damage estimated at £15,000 was done by fire on 21st inst., at the electrical works of Messrs. J. Dennis & Son, Knowle, North Devon.

Damage estimated at £5,000 was caused by an outbreak of fire at the electrical engineering works, Strabane, Co. Tyrone. The contents of the works were completely destroyed.

LIGHTING AND POWER NOTES

Australia.—Sydney. — The Chief Justice has been requested to nominate a Judge to hear the application of the City Council for power to increase the charges for electricity. It was expected that the application would be heard early in March. Mr. Forbes Mackay, general manager of the electricity department, in his last quarterly report, shows that the apparent loss on the trading for the quarter ended December 31st, 1920, was £28,043, and for the previous three quarters, £15,709, making the total loss for the year £43,752. In submitting his estimates for 1921, Mr. Mackay points out that as the City Council has undertaken the legal responsibility of supplying electricity in certain areas, it must do so, irrespective of what it costs to produce, so that the revenue and expenditure are practically beyond the control of the City Council or its officers. On the basis of the past year's working he estimates a loss of £38,000 during the current year.—*Sydney Morning Herald.*

Ayrshire. — Street Lighting. — The Irvine Town Council has decided next lighting season to light the main streets of the town with electricity and to fit the gas lamps in the side streets with wave pressure mechanism.

Bognor.—New Diesel Plant.—The Electricity Commissioners have granted permission for the Bognor Gas-Light and Coke Co. to replace an old 30-kW Diesel engine by a new 90-kW set, the output of the station having been practically doubled during the last 18 months.

Continental.—Spain.—Application has recently been made to the Spanish Government for a concession to establish a plant to utilise the water power of the River Nalon, near Laviana, to generate electricity.

Belgium.—La Société Intercommunale Belge d'Electricité in order to meet the ever-increasing demand for energy is erecting two large generating stations at Alost and Monceau-Sur-Sambre, which will increase the supply capacity up to 100,000,000 kWh. The area supplied comprises Louvain, Malines, Saint-Nicholas, Termonde, Alost, Roulers, Courtrai, Renaix, Mons, and Charleroi.

France.—The works of the Compagnie Electrique du Nord, at Beautor, department of the Aisne, were totally destroyed during the war. The reconstruction, begun at the beginning of 1920, is far advanced. The equipment of the new works comprises 16 Babcock boilers; two 6,000-kW turbo-alternators; one 10,000-kW and, later, two 10,000-kW turbo-alternators. Energy will be generated at 5,000 volts for the district and 45,000 volts for the main lines. The latter include:—A line in the direction of Hirson, two to Cauchy, whence distribution will be made to all the Northern mines, a line to Compiègne and Beauvais, one to Chauny, Soissons, and Pont-Ste.-Maxence, and one in the direction of Laon and Rheims. The partial commissioning of these installations is reckoned upon towards the end of the current year.

Russia.—According to the *Deutsche Allgemeine Zeitung*, for some months past the Russian Soviet Government has been making great efforts to supply towns and large industrial districts with electric power. The largest of the hydro-electrical stations to be erected by the main committee for municipal undertakings of the People's Commissaries is that of Svir-Volkovskaya. This station is expected to deliver one milliard kWh of electrical energy in the year—*i.e.*, twice as much as Petrograd consumed in 1916; this corresponds to a daily uninterrupted supply of 180,000 h.p. The station will be the largest in all Europe. In addition to supplying cheap electric power, the erection of the station will make shipping possible on the Svir, a tributary of the Marinskoye, whereby a connection will be made with the Volga and the Baltic. The works in connection with the station were commenced in 1918, and, according to the *Ost-Europa-Markt*, are making great progress.—*Economic Review.*

Extracts, published in the *Journal of Electricity and Western Industry*, from a paper read at the Eighth All-Russian Congress of Soviets, by M. Krzyanowski, show that "the railroads of the northern regions are to be electrified. The electrification of the Murmansk Railway is also to be undertaken soon. Great power stations are being built on the White Sea, and at Murmansk. There is excellent water power in this region, convenient sources for the production of electrical energy. Entirely new conditions for production are thus being created for the North. Great nitrogen works are there being established, also aluminium works. With artificial nitrogen, as well as with potash, it is intended to intensify agriculture in these regions. A connection by electric railway will be effected between the White Sea, Murmansk, and Petrograd. The Petrograd region will thus become an absolutely modern transportation region, with Petrograd as its central point. It has been calculated that in the region on the White Sea a million horse-power (in water power) can be exploited.

"The Petrograd region will therefore obtain power stations which will serve the transportation routes to the seas and to the interior, create new industries by using the mighty water power resources, and intensify agriculture into a model economy. The electrical line from Murmansk to Petrograd will render possible the opening up of the ice-free port of Murmansk, which hitherto has been very little used."

Jugo-Slavia.—The Jugo-Slav Government is preparing a scheme for the erection of a central power station at Kostolnat, on the Danube, 90 km. below Belgrade, which is to supply electric power and lighting to Belgrade, Smederevo, Pogurévatz, Gotzka, Kovine, Panuchovo, and Zenun. The Ministry of Public Works has received numerous tenders from contractors.—*Review of the Foreign Press.*

Coventry. — Bulk Supply Charges. — The City Council on April 26th received a statement from the Electricity Committee that the manager had reported that the decision of the Committee of February 28th, 1921, regarding the scale of charges on the high pressure or bulk supply rates, had been conveyed to the Engineering and National Employers' Federation, and that, in response to a request, the chairman and himself had interviewed representatives of the Federation upon the subject, when the Federation asked that the following questions should receive consideration :—(1) The maximum charge for bulk supplies should not exceed the price charged for power to low-pressure consumers ; (2) The percentage increase should be equitably distributed over the whole of the consumers. It was resolved that the Committee was unable to alter its previous decision.

Douglas (I. of M.).—Electricity Bill.—On April 15th the Douglas Electric Light and Power Bill was given a second reading in the Legislative Council. An amendment had been proposed by the Douglas Gas Light Co. This took the form of a clause stipulating that the prices charged for energy should be sufficient to cover the cost of production. Counsel for the Douglas Corporation (the promoters of the Bill) objected to the inclusion of such a clause. There was not a similar case in England, because in that country there were no gas companies, like the Douglas Gas Co., with unlimited powers to charge. It was agreed finally that the clause should be printed with the Bill, when it could be dealt with by the House of Keys. The Bill was then read a third time and passed.

Dungannon (Co. Tyrone).—Electricity Scheme.—At a meeting of the Urban Council, the clerk stated that one of the Committees had considered the question of public electric lighting, and asked the Council to deal with it. As far back as 1902 a Provisional Order was obtained, but the powers were allowed to run out, and they would now have to start afresh. Mr. Joseph Newell said the estimate at that time, made on the advice of the best experts in the United Kingdom, was for an outlay of £4,000. The only objectors were the Gas Co.'s shareholders. The Council referred the matter to the Finance and Lighting Committee to prepare data and report.

Dutch East Indies.—Water-Power Development.—New projects for the development of water power in the Netherlands East Indies continue to be launched, or to come up for consideration, whilst good progress is made with schemes already in hand. The Netherlands Indies Chamber of Commerce states that work on a power station in the Residency of Batavia was commenced last year, and it is presumed that when this station is finished more than 50,000 h.p. will be generated. The power from this station is designed to electrify the Batavia Railway and to supply light and power to the towns which the railway serves, among which Tandjong, Priok, Batavia, Meester Cornelis, Buitenzorg, and Soekaboemi are the best known. In the Preanger Regencies plant is under construction having an initial capacity of 3,300 h.p, and as soon as this is running an additional water reservoir is to be constructed, so that the initial power of this station may be doubled. On a tributary of the Tjisadana, to the west of Buitenzorg, still another station is to be erected, and the machinery at this third point of generation is calculated to develop between 25,000 and 28,000 h.p. The preliminary plans for this work have been completed already, and as soon as the machinery can be obtained actual constructional work will commence.—*Eastern Engineering.*

Electricity District.—West Riding (Aire and Calder) Inquiry.—The postponed inquiry which is to be held by the Electricity Commissioners at Leeds, has been fixed to take place on May 18th, at the Civil Court.

Golborne.—Bulk Supply.—In reply to an inquiry from the Lancashire Electric Power Co., the Urban District Council is to ask for estimates (*a*) for supplying electricity in bulk to the Council, and (*b*) for supplying and distributing the electrical energy itself.

Greenlaw.—Electricity Scheme.—Berwickshire County Council has decided not to take up the Greenlaw electric lighting scheme. A private company has been formed to carry out the project.

Londonderry. — Proposed Extensions. — The City electrical engineer (Mr. R. V. Macrory) has submitted a report to the Corporation upon the extensions necessary at the electricity works. These entail a cost of £53,500, made up of the following items :—One 3,000-kW turbo-alternator, &c., £27,000 ; switchgear and cubicles, £500 ; two boilers, chimney, &c., £15,000 ; one 1,000-kW rotary converter, &c., £6,000 ; foundations, £1,500 ; and contingencies, £3,500. Of this amount the Electricity Commissioners are prepared to sanction £40,227, subject to a deduction of £2,727 for the sale of old plant. This reduction is to take into account an almost certain fall in the cost of plant and materials before the extensions are finally approved. In addition to these plant extensions, further expenditure to the extent of £15,500 is recommended. This sum includes items of £6,500 for mains extensions, £4,000 for consumers' services, £1,200 for meters, and £1,000 for pillars, boxes, &c. The Commissioners approve the borrowing of this amount, with the exception of £2,000 for completion of a culvert and half the proposed expenditure upon meters. The engineer estimates that these extensions will increase the gross profits in 1922 from £3,594 to £16,558.

London. — St. Pancras. — The Borough Council is recommended to accept a loan of £20,765 for electricity purposes, offered by the London County Council. Application is to be made to the Electricity Commissioners for sanction to borrow £40,272 for the purchase of two water-tube boilers and £2,700 for the erection of a ferro-concrete pump house at the King's Road station.

Navan.—Electricity Scheme.—At an Urban Council meeting regret was expressed that the public electric lighting scheme had been postponed for 12 months, and it was decided that the earliest possible moment should be availed of for reviving and proceeding with it.

Newport (Isle of Wight).—Street Lighting.—The Electric Light Co. has informed the Town Council that the charge for electricity for public lighting has been increased as from April 1st from 4½d. to 6d. per unit.

Portrush.—Progress of Electricity Scheme.—The Irish Local Government Board having agreed to sanction a loan, the Urban Council has accepted the tenders of Messrs. Curran Bros. at £12,508 and Messrs. Cochrane & Elliott at £1,652 for the new electric lighting scheme, subject to satisfactory terms being fixed for the different sections and the early completion of the work as a whole.

Preston.—Purchase of Undertaking.—The Finance Committee has had under consideration a report of Mr. J. A. Robertson respecting the purchase of the undertaking of the National Electric Supply Co. and the provision of a new generating station on the South side of the River Ribble. The report has been adopted, and an application recommended to the Commissioners for a special order authorising the Council to supply electricity.

Ryde (I. of W.).—Street Lighting.—Owing to the high initial cost of lighting the town by electricity, the Town Council has decided to enter into a contract with the Gas Co.

Salford.—Street Lighting.—The Town Council is to apply for sanction to borrow £3,000 to cover the cost of street lighting by electricity required in connection with Lower Kersal and Weaste housing estates.

South Africa.—Electricity Supply Bill.—The Union Government has introduced an "Electric Supply Bill," providing for the establishment of an Electricity Board in which the control of electricity supply is to be vested, and which will decide all questions relating thereto. Provision is made for the appointment of local committees consisting of suppliers and consumers, which will have no executive powers, but will act in an advisory capacity. The Bill provides also for the establishment of Government generating stations, the first of which will probably be those required for the electrification of the railways. Sections will provide for a certain measure of control over municipal supplies. The various municipalities having electricity supplies are vigorously opposing the Bill so far as it affects their interests.

Southend.—Proposed Extensions.—In a report to the Corporation, the Electricity and Light Railways Committee recommends the following additions at the electricity works to meet present and future demands until a larger scheme can be put into operation : — Two 1,500-kW turbo-alternators, £40,500 ; motor-converters, £28,680 ; boiler, economiser, and accessories, £20,000 ; alterations to buildings, £4,000 ; foundations, £2,000 ; switchboard, l.p. and h.p. cables, pipes and valves, £9,250, making, with an addition of 10 per cent. for contingencies, £114,873, or £38 6s. 8d. per kilowatt.

Tamworth.—Electricity Scheme.—The Rural District Council has assented to the Atherstone and District Electricity Co.'s proposals to supply the district, on the understanding that the mains are laid within two years.

Walkerburn.—Hydro-Electric Scheme.—Messrs. H. Ballantyne & Sons have recently completed a scheme for supplying power to their two mills by means of the works on the Tweed. Two high-speed turbines have been installed, and a reservoir has been constructed in the adjacent hills at a height of 1,000 ft. By means of this reservoir, which is filled by pumping during the night and the week-end, the power obtained directly is augmented to meet the full requirements of the mills, a total of 450 h.p.

Weybridge.—Price Inquiry.—The Ministry of Transport is to hold a local inquiry, on May 3rd, into the circumstances in which the Urban Electric Supply Co. has applied for permission to increase its prices for electricity.

Worcester.—Proposed Extensions.—In bringing forward recommendations of the Electricity Committee to carry out extensions to the undertaking at a cost of £62,200, the chairman of the Committee said that the sum required to meet immediate demands was £3,900. The report was adopted.

TRAMWAY AND RAILWAY NOTES.

Australia.—Melbourne.—The Melbourne Press complains of the overcrowding of the cable cars, which recently has become very serious. Since the electric tramways were introduced as feeders to the cable routes in the city, the cable cars have proved totally inadequate. It is stated that the cable routes cannot be electrified for at least six years.

Bradford.—Permanent-Way Renewal.—Having failed to secure the sanction of the Ministry of Transport to run railless cars on the Eccleshill, Idle, and Thackley routes to save the cost of relaying the track, the Tramway Department is having to renew the permanent way at a cost of £35,700. The Advisory and Co-ordination Committee, whose duty is to cut down all avoidable expense of Corporation Committees, has approved the Tramway Committee's recommendation that the reconstruction of the Bolton Road track, from Wapping Road to Lister Lane, be proceeded with immediately.

Bury.—Year's Working.—The loss on the tramway undertaking last year was £10,872, and on the Ratcliffe section £2,598. It has been decided to make good the deficiency out of the borough rate. Traffic receipts were £131,712, against £122,791 the previous year, and the total wages were £63,976, against £51,423. The amount paid for electrical energy was £17,597, against £15,251, and materials, &c., cost £31,706, against £18,857.

Continental.—France.—Sanction has been accorded to schemes proposed by the Chemin de Fer d'Orléans in the departments of the Cantal, Corrèze and Puy de Dôme, for the utilisation of the waters of the Upper Dordogne, Chavanon, and Rhue, for the generation of electricity for the working of its network, and more particularly for the Paris-Orleans line. The estimated average power obtainable, 70,000 kW, represents a yearly output of 400,000,000 kWh, equivalent to between 400,000 and 500,000 tons of coal. The plans for the utilisation of the Upper Dordogne are part of a general scheme for dealing with the whole of that river. They include in particular the construction of huge regulating reservoirs, which, by increasing the flow and lessening the rise, will allow of the fuller utilisation of the energy of the river, which totals at least 250,000 kW. The company is under special stipulations as to the disposal of the excess power, priority being given to the departments and owners of distribution concessions, the tariff being arranged by the Minister of Public Works. The highest points of this tariff are already fixed by a detailed scale, revisable periodically.

Le Triphasé, one of the companies which supplies the suburbs of Paris, is applying for authorisation and eventually a concession to lay a high-pressure underground main from its station at Asnières to Genevilliers, the Ile Saint Denis, St. Denis, and Epinay.

Sweden.—Sums amounting to 10,600,000 kroner have been voted by the Swedish Parliament for various railway extensions—namely, on the Inlands Railway, from Volgsjön to Gullivare, from Porjas to Jockmock, and from Jörn to Gubbljaure; and on the State railway system from Forsmo to Hating and Hällnäs to Stensele.

Italy.—A scheme to build an electric railway between Milan and Valtidone has been under the consideration of a meeting of provincial deputies and representatives of the communes of the three provinces represented, and it has been decided to make application for a concession, and to take steps to form a company to construct and work the line.

Doncaster.—Conductresses.—As a result of a conference between the Tramway Committee and the local branch of the Comrades of the War and representatives of the Unemployment Committee, it has been decided that the 20 conductresses still retained since the war shall be replaced by men. When the war ended there were 100 women in the service.

Hastings.—Strike.—The employés of the Hastings Tramways Co. came out on strike on Saturday owing to the dismissal of an inspector for alleged inefficiency.

Jamaica.—Cost of Railway Electrification.—*The Times* Kingston correspondent says that discussion is proceeding in Jamaica over the wide difference in the matter of cost mentioned in two reports which are before the Government for the proposed electrification of the Government Railway. The first report, by an expert of the American Westinghouse Co., indicated that the enterprise would cost £1,000,000, while the report presented by British engineers gave the cost as nearly double that sum. It is stated that there is considerable risk of the contract going to the United States if electrification is decided upon, as the British estimate is regarded as prohibitive.

Leeds.—Year's Working.—The Tramway Department has yielded a surplus of £5,580 on the past year's working, instead of a deficiency of £15,000 which was anticipated. Some months ago the situation looked very bad, but in recent times the department has made great headway and improved receipts. The exceptionally fine weather of the early spring is looked upon partly as the cause of the improvement, and bigger dividends on investments have helped. In spite of increased fares, the number of passengers carried has increased. At the same time, in view of the difficulties of the present times and the cost of renewals, &c., the department has decided that it is necessary to apply for powers to increase the statutory maximum fare from 1d. to 2d. per mile, though it does not follow that the new maximum, if secured, will be put into practice.

London.—Cheap Fares.—At the meeting of the L.C.C. on April 19th, the Chairman of the Highways Committee, replying to a question regarding the institution of long-distance 1d. fares upon the tramways in the middle of the day, said that close consideration was necessary before the matter could be decided upon; the deficit of £550,000 had to be faced.

Rochdale.—Year's Working.—Although the past year's revenue was £186,855, an increase of over £25,000 on the previous year, the increased expenditure on the Corporation tramways involved a loss of £9,335. There was a loss of £2,682 a year ago, and to provide for this total deficit of over £12,000, it is proposed to use the whole of the reserve fund, £10,282, and to rate for the remainder. The gross profit was £79,160, but capital and other charges show an increase of over £17,000. Increased fares were in operation for nine months of the year.

Swansea.—Threatened Strike.—*The Times* states that the Swansea tramway and omnibus employés have decided to strike to-night (Friday) if the coal dispute is not settled by that time.

United States.—Traffic Control.—A new type of traffic tower is being erected at a busy crossing in Detroit. The new tower is rectangular in shape, and is higher than the towers formerly used. The tower is located at an extremely busy and dangerous intersection, being in front of the city hall where Michigan and Monroe intersect Woodward Avenue. As the streets converge at this point, the intersection is broad, and the traffic is very congested on account of travel proceeding in various directions at sharp angles and turns being varied and not at right angles. Pedestrians find considerable difficulty in negotiating street crossings at this point. The new tower places the traffic officer well above the street, so that a clear view of all traffic can be obtained. Movement of street cars and vehicles is governed both by day and night by coloured lights, the lamps resembling automobile headlights in size and design. The lamps are mounted on top of the tower. Signal bells mounted on street lamp poles at the kerb corners are also used to give signals that traffic shall proceed or stop according to the regulations indicated by the coloured lights. Red, green and yellow lights are used to indicate the various movements of traffic.—*Electric Traction.*

Yorkshire.—Fare Increase.—The Rawdon District Council, last week, protested vigorously against the proposed application by the Leeds tramway department for authority to increase the statutory maximum fares from 1d. to 2d. per mile. It was pointed out that the fares had already been increased, and any further increase, now that prices were falling, should be avoided. The fare between Leeds and Rawdon, originally 4d., was now 6½d., and when a profit was made Rawdon ratepayers got no benefit in the way of relief of rates from the Leeds tramways.

The Yeadon District Council is also formally to oppose the application. It was held that the increase, if put into operation, would double the fares of ordinary passengers and increase workmen's fares four times.

At the Pudsey Town Council meeting, last week, Mr. J. B. Hyland, objecting, contended that both Leeds and Bradford, which served the district with tramways, forgot that in the past they had taken tremendous amounts out of their tramway undertakings for the relief of their own rates, and now they were beginning to lose a little they wanted other people to pay. The matter was left in the hands of a Sub-Committee.

TELEGRAPH AND TELEPHONE NOTES.

China.—New Wireless Station.—*Finance and Commerce* learns that the Mitsui Bussan Kaisha is constructing a high-power wireless station about 9 miles east of Peking, the plant covering nearly 1,000 mow. The sending station in the east, and the receiving station in the west, are about a mile apart. The power house and four of the six steel towers, each 700 ft. high, are finished; the remaining two towers will be ready within two months. The construction of this plant, which was commenced last April, was delayed by prolonged negotiations with over 300 small landowners, who had to be bought out. The contract with the Chinese Government was signed on February 21st, 1918, but no time was set for the completion of its provisions. The contractors guarantee the amortisation of the capital invested. The Government is reported to be considering the establishment of wireless telegraph stations at Chefoo and Weihsien, in Shantung, thus covering the district east of the Kiaochow-Tsinan Railway built by the Germans.—*Reuter's Trade Service* (Shanghai).

France.—Wireless Telegraphy.—At present France possesses four large transmission stations—Eiffel Tower, Basse-Lande, La Doua (Lyons), and Croix-d'Hins (Bordeaux); and six large receiving stations—Villejuif, Poitiers, Basse-Lande, Eiffel Tower, Neufchalet, and Chartres, which ensure communication with the outer world. Already commercial services are established with Great Britain, Hungary, Jugo-Slavia, Bulgaria, Rumania, the United States, China, Madagascar, and Africa, North, Central, and West. A scheme is being prepared for an inter-colonial service with stages at Saida, Bamako, Brazzaville, Tananarivo, and Saigon. The Ministry has also entrusted the Extra-Parliamentary Wireless Telegraphy Commission with a supplemental scheme to include Djibouti, Noumea, Tahiti, the Martinique, and Guyana. Thus every French colony will possess a wireless station. There is a marine wireless system which places vessels in communication with Cherbourg, Lorient, Bayonne, and Oran, and the stations at Boulogne, Havre, Ushant, Bordeaux-Bousiat, les Saintes-Maries de la Mer, Marseilles, Nice, Bonifacio, and Algiers, are also open to business messages. The principal shipping companies have signed agreements with the wireless companies for the transmission to their vessels of news from the wireless stations. In France, local services have been established, especially among the hills, in order to provide against the breaking of telegraph wires in bad weather, and along the coast for communication with the adjacent islands. A contemplated interdepartmental service has been abandoned for financial reasons. In order to render the long-distance services more methodical, the hours for transmission to various parts of the world have been fixed according to a regular time-table. For instance, from Croix-d'Hins messages are dispatched to Shanghai from 3 to 5, to Tananarivo from 5 to 6, to Brazzaville from 7 to 9, and to the United States (Tuckerton) from 9 a.m. to 5 p.m., &c.—*Exportateur Francais.*

Guernsey.—The accounts of the Guernsey States Telephone Department for 1920 show total income £10,153, expenses (including allowances for sinking funds and depreciation, £2,827), £10,102, leaving a net profit of £51. The capital expenditure on construction account amounted to £62,131; £5,719 had been paid off a States 3 per cent. loan of £32,000 raised in 1905, and the reserve funds for depreciation and contingencies amounted to £32,692, but of this sum £30,131 had been used on construction work. A special sinking fund for the redemption of amounts taken from reserve for construction work amounted to £4,133. The number of subscribers' lines was 2,208; total number of lines, 2,662; and the number of calls was 1,668,767.

Italy.—New Wireless Plant.—By a Decree dated December 20th, 1920, approval is given to an agreement come to between the Italian Ministry of Posts and Telegraphs and the Italian Ministry of the Marine, providing for the radical transformation of the wireless plant at the Coltano naval wireless station, which is now to be equipped with the most modern machinery and apparatus for the transmission and receipt of messages, both private and public. A new station is to be built, which will be linked up with the State telegraph system, and be able to transmit messages across the Atlantic, and to the greatest distances. After the completion of the modernisation the station is to be handed over to the Ministry of Posts and Telegraphs.

New Zealand.—Printing Telegraphs.—Telegram printing is not exactly a new discovery, but the application of electrical machines which will enable a message to be typewritten at one end and received printed at the other is new to New Zealand. Some machines of this description were due to arrive in Wellington by the first week in March. Mr. E. A. Shrimpton, chief telegraph engineer, stated to the *Auckland Weekly News* that the consignment consisted of two multiplex machines, and one start-stop combination, which would enable communication by printed telegram to be established almost at once, either between Wellington and Christchurch or Wellington and Auckland.

Nova Scotia.—Meteor.—The Cunarder *Saxonia*, which arrived at Halifax, N.S., on the 19th inst., reported seeing at noon, 15 miles off Halifax, a meteor hurtling from the clouds at an angle of 45°, which burst into flames near the water, leaving a column of smoke behind it. The event was also seen from several points on land. Wireless operators reported unusual electrical disturbances for a period of 24 hours prior to the event, which ceased after the fall of the meteor.

Philippines.—New Cable.—The Commercial Pacific Cable Co. recently completed the laying of an underground cable between the towns of Sorsogan and Bacon, across the Sorsogan Peninsular, Lower Luzon Island which will connect at Bacon with the Commercial Pacific Cable Co.'s submarine cable running from Guam, and at Sorsogan will be joined up with a section of submarine cable running to Manila. This change has been made to remove the submarine cable from the San Bernardino Straits, where strong currents and a rough bottom have frequently been the cause of interruptions. The underground cable was manufactured by the Okonite Co., Passaic, N.J., and the whole change was expected to be completed by the end of April.

The cableship *George Ward* was at the end of March engaged in repairing one of the French Co.'s cables off the coast of France. This was her first work as a cable-ship; she was formerly the steam yacht *Beryl*, and was at one time used by the Prince of Monaco for deep-sea research work in all parts of the world.

This company has opened a new cable office at 75, Edmund Street, Birmingham, with direct connection with the ocean cables. —*T. & T. Age.*

Spain.—Semaphore and Wireless Station.—Endeavours are being made to obtain the construction of a semaphore and a wireless telegraph station on Monte Ferro at Vigo, but several details remain to be settled before the plan can be carried out.—*Reuter's Trade Service* (Barcelona).

Telegraph Service.—Deferred Telegrams.—The Postmaster-General announces that the deferred service by the routes of the North Atlantic Cable Companies (Anglo-American, Commercial, French and Western Union) to Canada, U.S.A., Cuba, British West Indies, and Australasia, has been restored. The rates chargeable are, in most cases, one-half of the ordinary rates shown in the "Post Office Guide."

The rate figures for Canada are still applicable to the route *via* Imperial, and to that route only.

Deferred telegrams for Australasia, British West Indies and the United States may be sent *via* Imperial at the same rates as by the other routes.

Figures are not allowed in the text of deferred telegrams by the above-mentioned services, except in the case of telegrams for Canada, British West Indies and Australasia routed *via* Imperial.—*Board of Trade Journal.*

On and after May 1st the rate for telegrams to Tanganyika will be increased to 2s. 4d. a word to Dar-es-Salaam, and 2s. 6d. a word to places inland.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Argentina.—June 13th. The Department of Overseas Trade has been informed by telegram that the Department of Sanitary Works is calling for tenders for the supply and erection of electric power batteries and lighting plant at Mar del Plata. Local representation is essential. When a copy of the specification is received by the Department of Overseas Trade it will be made available for consultation.

Australia.—Melbourne.—Postmaster-General's Department. May 31st. Telephone switchboards (Schedule No. 1,670).*

May 31st. P.M.G. 29,500 porous cells, No. 1 size to specification (Schedule No. 1,685); 20½ tons ammonium chloride (Schedule No. 1,683).*

May 31st. Victorian Electricity Commissioners. Morwell power scheme: Street poles (Specification No. 47); copper cable (Specification No. 66). (April 15th.)

June 15th. Victorian Government Railways. 50 oil-immersed single-phase track and signal transformers for power signalling (Contract No. 33,901).*

June 22nd. One electric lifting magnet (capacity ½ ton), one 440-V motor generator.

June 29th. Supply of 1-ton platform type industrial storage battery trucks, also battery-charging equipment.—*Reuter's Trade Service* (Melbourne).

August 10th. 250 core-type impedance bonds for power signalling, with a capacity of 1,000 amperes per rail; also 50 miles of solid insulated copper wire, No. 14 Brown & Sharpe gauge, and 10 miles of solid insulated copper wire, 16 standard gauge.

August 17th. 3,000 sets of renewals for caustic soda primary cells.—*Reuter's Trade Service* (Melbourne).

August 30th. Board of Works. Four electrical centrifugal pumps, each with a capacity of twelve million gallons daily.—*Reuter's Trade Service* (Melbourne).

Perth.—May 25th. Postmaster-General's Department. Ironwork, as per Schedule 704. (April 22nd).

Barnsley.—May 3rd. Town Council. Electric light wiring for 100 houses. C. F. Moxon, architect, 3, Regent Street South.

Belgium.—May 27th. The Service d'Etudes et de Controle des Applications de l'Electricité, 52, Boulevard du Regent, Brussels. For the supply and installation of ten electrically-operated capstans in connection with the locks on the Upper Scheldt.

April 28th. Municipal authorities of Saint-Gilles-lez-Bruxelles. Cooling plant for the electricity generating station. Specification from the Service de l'Electricité, R 40, Rue de Bethléem, Saint-Gilles, near Brussels. Tenders to the College Communale.

May 5th. Municipal authorities of Erquennes (Province of Hainaut). Installation of a primary and secondary electricity distribution system in the town. Tenders to the Maison Communale, whence particulars may be obtained.

Brussels.—May 11th. Belgian Post and Telegraph authorities at La Salle de la Madeleine, Brussels. Supply of a quantity of telegraphic and telephonic apparatus, including 600 Morse manipulators and 250 milli-amperemeters.

Buenos Aires.—June 3rd. Board of Sanitary Works. Supply and erection of the plant and accessories for a new generating station, previous tenders having been called for in 1919 and 1920. The plant comprises three four-cycle Diesel engines of 375-h.p., and adapted to run on crude petroleum from Comodoro Rivadavia, and three three-phase alternators, each of 250-kW, 2,200 volts between phases, 50 cycles and a power factor of ·8.*

Edinburgh.—May 26th. Electricity Department. E.h.p. and l.p. switchgear for sub-station.

Fiji Islands.—The municipality of Suva invites tenders, closing June 30th, for the supply and erection of a 200-kW, 480/520-V, three-wire, d.c. generator, directly coupled to a 300-h.p. vertical Diesel oil engine, together with accessories for generator and panel.—*Reuter's Trade Service* (Melbourne).

Ipswich.—Electricity Supply Department. One 500-kW rotary converter or motor converter. (April 15th.)

Jugo-Slavia.—May 1st. The Serb, Croat, and Slovene Ministry of Public Works. Erection of a power station, main conductors and transforming stations in connection with an electrical scheme at Kostolac for the supply of energy to Belgrade, Semlin, &c.*

Commercial Secretary to H.M. Legation at Belgrade has received an inquiry from a local contractor with regard to plant, &c., required for the electric lighting of a town in Serbia. The inquirer wants offers from United Kingdom firms for two 40-kW dynamos and 50 km. of overhead cable, &c., for the supply of current to about 1,200 houses. The Serb-Croat-Slovene State is one of the countries to which the Export Credit Scheme applies. The name and address of the inquirer may be obtained on application to the Department of Overseas Trade in London.

London.—Fulham.—May 4th. Electricity Department. Two Green economisers or other approved make of 400 and 440-tube capacity respectively. (April 22nd.)

St. Pancras.—Electricity Department. Paper-insulated, lead-covered, and armoured cable. (See this issue.)

Manchester.—May 2nd. Electricity Committee. Three steam turbine-driven boiler feed pumps. (April 15th.)

May 10th. Electricity Department. Weldless steel lamp columns. (See this issue.)

New Zealand.—June 28th. Public Works Department. Ten a.p. oil-filled transformers for the conversion of three-phase current at 50 cycles, the voltage ratio being 50,000/11,000, for Waikato power scheme.*

June 28th. Supply and delivery at Lyttelton of two 50-kVA, two 100-kVA and two 200-kVA condensers in connection with the Lake Coleridge electric power supply (Section 116).*

South Africa.—Pretoria.—May 10th. Municipality. Switchgear. Tenders, marked "Electric Light and Power Department, 1920 Extensions, Contract No. 5," to Deputy Town Clerk, Municipal Offices, Pretoria. Deposit, five guineas. Further particulars may be obtained from the general manager of the Electric Light and Power Department, or from the consulting engineer, Mr. G. M. Clark, 40-42, Meischkel's Buildings, Johannesburg.

Southampton.—May 14th. Electricity Department. 3-phase, 6,000-V cable. (See this issue.)

Uruguay.—June 28th. Ministry of Public Works. Three electric gantry cranes and a "Temperley" type aerial transporter for the Port of Paysandu. Tenders in Spanish and framed in accordance with the model to the Ministry of Public Works.*

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.

Belgium.—Ten firms submitted tenders last week to the Service d'Etudes et de Controle des Applications de l'Electricité, in Brussels, for the supply and installation of the necessary plant for the electrical operation of the locks on the Upper Scheldt. The lowest was that of Messrs. Bracke & Monin, of Ghent (853,452 francs), and the highest that of the Société Anglo-Belge d'Electrique, of Brussels (1,296,557 francs).

Government Contracts.—The following Government contracts were placed during March, 1921:—

Admiralty (Contract and Purchase Department).

Electrically-driven booster set.—Electric Construction Co., Ltd.
Fans and spare parts.—Veritys, Ltd.
Insulating materials.—H. Clarke & Co. (Manchester), Ltd.; Mica and Micanite Supplies, Ltd.; E. J. North Hardy & Son.
Motors.—Lancashire Dynamo Co., Ltd.
Switchboard panels.—British Thomson-Houston Co., Ltd.
Transformers.—Metropolitan-Vickers Electrical Co., Ltd.

War Office.

Valves for wireless telegraphy.—General Electric Co., Ltd.; Mullard Valve Co.
Electric lighting (Windsor Combermere Barracks).—Jackson & Boyce.

Post Office.

Protective apparatus.—Evershed & Vignoles, Ltd.
Telegraph apparatus.—Power Equipment Co., Ltd.; Walters Electrical Manufacturing Co., Ltd.
Telephone apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.; A. C. Cosser, Ltd.; Peel-Conner Telephone Works; Phonophore Construction Co., Ltd.; Reid Bros. (Engineers), Ltd.; Sterling Telephone and Electric Works, Ltd.
Leclanché battery boxes.—Siemens Bros. & Co., Ltd.; W. D. Tucker and Sons, Ltd.
Telegraph and telephone cable.—Callender's Cable & Construction Co., Ltd.; Hackbridge Cable Co., Ltd.; London Electric Wire Co. and Smiths, Ltd.
Cords for telephones.—British Insulated & Helsby Cables, Ltd.
Cable drums.—Western Electric Co., Ltd.
Ducts.—Mountford, Phillips & Co. (1920), Ltd.
Electric cable-hauling machine, Dover submarine cable depot.—Johnson and Phillips, Ltd.
Laying conduits.—Birmingham-Worcester (section I): Wyatt Bros. Camberwell, Southwark, &c.; Acton Vale, Kensington, Paddington, and St. Marylebone, Southwark Street area, Brighton-Worthing (section II); Portsmouth, Shedfield, and Willesden, Wembley, &c.: O. C. Summers, Dudley-Stourbridge, Cradley Heath, and Birmingham-Dudley-Tipton: Martin & Element, Ltd. Wallsend: W. Turner (Ardwick), Ltd. Belfast-Newtownards: J. Ross & Son. Manchester-Bury-Burnley (N.W. district): J. Wimpenny & Co. Hornsey, Islington, &c., Hammersmith, &c., Fulham, &c., and Westminster, Chelsea and Holborn: A. Thomson and Co. Weybridge, Woking, Chertsey, Byfleet, &c.: Hardy & Co. London-Dartford-Chatham (Gravesend Spur): H. Farrow. London-Uxbridge-High Wycombe (South Midland section II): Grieg & Matthews.
Manufacture, supply, drawing-in, and jointing cable.—Mill Lane-Streatham Exchange and Reading Spur: Western Electric Co., Ltd. London-Weybridge: W. T. Henley's Telegraph Works Co., Ltd.
Transmitting set (North Foreland Wireless Station).—Radio Communication Co., Ltd.
H.D. coper wire.—R. Johnson, Clapham & Morris, Ltd.
Enamelled wire.—London Electric Wire Co. & Smiths, Ltd.
G.I. strand wire.—Shropshire Iron Co., Ltd.; F. Smith & Co. Wire Manufacturers, Ltd.

High Commission for India.

Accumulators.—Edison Accumulators, Ltd.
Cells (sections).—J. Stone & Co., Ltd.
Armature coils.—General Electric Co., Ltd.
Crucibles.—Morgan Crucible Co., Ltd.
Insulator cups.—Taylor, Tunnicliff & Co.
Dynamos, &c.—J. Stone & Co., Ltd.
Ebonite.—North British Rubber Co., Ltd.
Generating sets.—General Electric Co., Ltd.
Switchboard.—Ferguson, Pailin & Co., Ltd.
Voltoids.—Brunner, Mond & Co., Ltd.
Copper wire.—British Insulated & Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.

Crown Agents for the Colonies.

Electric light fittings.—Chloride Electric Storage Co., Ltd.
Lux cells.—Chloride Electric Storage Co., Ltd.
A.c. motors.—British Thomson-Houston Co., Ltd.
Pumps and motors.—Metropolitan-Vickers Electrical Export Co., Ltd.
Stoneware troughing.—Callender's Cable & Construction Co., Ltd.
Switchboard section.—Siemens Bros. & Co., Ltd.
Telegraph poles and insulators.—Bullers, Ltd.
Telephones.—British L. M. Ericsson, Manufacturing Co., Ltd.
Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.
Telephone switchboard.—British L. M. Ericsson Manufacturing Co., Ltd.
X-ray apparatus.—Watson & Long.

H.M. Office of Works.

Engineering services, Hertford House electric lift.—W. Wadsworth and Sons, Ltd. Houses of Parliament, main and sub-main boards: British Thomson-Houston Co., Ltd. Kew, insurance office electric wiring: Alpha Manufacturing Co., Ltd. Leeds, removal and erection of electric lift: Marryat & Scott, Ltd. National Physical Laboratory, cables, &c.: Pirelli-General Cable Works, Ltd.

Board of Public Works, Dublin.

Belfast, electric work and supplies.—A. Stevenson.

London.—Battersea.—Electricity Committee. The Committee recommends that the following contracts be renewed:—

Electricity meters.—Chamberlain & Hookham, Ltd., and Ferranti, Ltd., for one year.
Electrolytic meters.—Reason Manufacturing Co., Ltd., for one year.
Cables, &c.—Callender's Cable & Construction Co., Ltd., for one year.
Box compounds and Trendite bitumen.—Dussek Compounds, Ltd., for six months.

St. Pancras.—Electricity and Public Lighting Committee. Recommended:—

Erection of ferro-concrete pump-house, £2,700.—D. G. Somerville & Co.
Six 1,000-amp. circuit-breakers, two 2,500-amp. do., £164.—Park Royal Engineering Co. Eight tenders received.
Two additional water-tube boilers, complete with pipework, &c., £47,190.—Babcock & Wilcox, Ltd.

Rochdale.—The Corporation Tramways Committee has decided to order steel tires from Belgium. The tender quoted a price of £25 5s. per ton free at port at Antwerp, and, even after adding freight charge of £2 5s. a ton, there will be a saving of £17 10s. a ton as compared with British tenders. All the British quotations were at the same figure—£45 a ton.

Wellingborough.—Board of Guardians:—

Electrical work in connection with laundry alterations.—Wellingborough Electric Supply Co.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, April 29th. At Caxton Hall, Westminster, S.W. At 8 p.m. Lecturette, "Rambling Remarks on Expert Evidence," by Mr. W. A. Tookey.

Friday, May 6th. At Caxton Hall, Westminster, S.W. At 8 p.m. Lecturette, "Fire Resistance of Aggregates for Reinforced Concrete," by Mr. D. W. Wood.

Society of Engineers (incorp.).—Monday, May 2nd. At 17, Victoria Street S.W. At 5 p.m. Ordinary meeting.

Institute of Metals.—Wednesday, May 4th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 8 p.m. Annual May lecture, by Prof. T. Turner, on "The Casting of Metals."

Institution of Civil Engineers.—Wednesday, May 4th. At the Institution, Great George Street, S.W. At 4 p.m. Presentation of the Kelvin Medal to Dr. W. C. Unwin, F.R.S., by the Right Hon. A. J. Balfour, O.M., F.R.S.

Chemical Society.—Thursday, May 5th. At Burlington House, Piccadilly, W. At 8 p.m. Ordinary meeting.

Institution of Electrical Engineers.—Thursday, May 5th. At the Institution of Civil Engineers, Great George Street, S.W. At 6 p.m. Continuation of discussion on "Tariffs."

Scottish Centre.—Friday, April 29th. At Dundee. At 7.30 p.m. Paper on "Some Thermal Characteristics of Electric Ovens and Hotplates," by Messrs. E. Griffiths and F. H. Schofield.

Western Centre.—Monday, May 2nd. At the Grand Hotel, Bristol. At 5.30 p.m. Address by the President, Mr. Ll. B. Atkinson. A dinner will be held after the meeting at which the President will be present.

Edinburgh Electrical Society.—Friday, May 6th. At the Philosophical Institute. At 8 p.m. Annual meeting.

Roentgen Society.—Friday, May 6th. At Manchester. Paper by Prof. W. J. Bragg, and a demonstration by Prof. A. V. Hill.

NOTES.

The Kelvin Medal.—The presentation of the first award of the Kelvin Medal will be made by the Right Hon. A. J. Balfour, O.M., F.R.S., in the hall of the Institution of Civil Engineers, to Dr. William Cawthorne Unwin, F.R.S., on Wednesday, May 4th, at 4 o'clock.

The Medal was founded in 1914, principally by British and American engineers, to commemorate the achievements of Lord Kelvin in those branches of science which are especially applicable to engineering. The award is dealt with by a Committee of the Presidents of the representative British Engineering Institutions, after their consideration of recommendations received from similar bodies in all parts of the world, and, in accordance with the terms of the Trust, it is made to the person whom the Committee finds to be most worthy to receive this recognition of pre-eminence in the branches of engineering with which Lord Kelvin's scientific work and researches were identified.

Finsbury Old Students' Association.—The annual smoking concert of the Finsbury Technical College Old Students' Association was held at Anderton's Hotel, on April 22nd. Dr. G. T. Morgan, O.B.E., F.R.S., was in the chair, and all those present voted it a very successful affair, especially the musical programme arranged by Mr. L. M. Clark, A.I.C., F.C.S., which left nothing to be desired. During the evening a Wallis-Jones Medal was presented to Mr. L. Gowing Scopes, F.C.S., for the best paper contributed during the year by an old Finsbury student, his paper being on "The Properties of Some Chlorhydro-carbons and their Uses in Chemical Analysis."

Smoothing Out the Load Curve.—The following is an extract from a brochure entitled "Water Power and Fuel Problems," reprinted from the Tenth Annual Report of the Commission of Conservation, Canada:—"As a means of smoothing out the load curve, 'staggered' hours for closing appear to offer great promise. A recent investigation made in Boston showed that at least 15,000 kW in generating capacity would be saved on the system of the Edison Electrical Illuminating Co. if 30 industrial establishments would change their working hours by 30 minutes. Fifteen thousand kilowatts represent about one-sixth of the total estimated peak load of the Boston system for this winter. The comparatively small change in closing hours required to effect such a large increase in available capacity is very striking."

X-Ray Motor Ambulance.—An X-ray motor ambulance wagon, presented by the Eccentric Club to the College of Ambulance, and equipped by the Red Cross authorities, is now available for service in London and a surrounding area of 25 miles. Accompanying the wagon is an operator and staff of specially trained assistants and ambulance men. The ambulance is intended primarily for men disabled in the war, and for the sick or injured in civil life who are too ill to be moved. Application should be made for it by doctors, to the Managing Secretary, College of Ambulance, 56, Queen Anne Street, Cavendish Square, W.1 (Telephone, 4652 Mayfair). The ambulance is free to the poor, but charged for in the case of those who can afford to pay.—*The Times.*

The Lord Rayleigh Memorial.—It has been decided that the memorial to the late Lord Rayleigh, F.R.S., which is being promoted by a Committee of Fellows of the Royal Society and Members of the University of Cambridge, shall take the form of a plaque containing a medallion in Westminster Abbey. Up to the present time a sum of between £1,400 and £1,500 has been subscribed for that purpose.—*The Times.*

No May-Day Strike in Paris.—The Paris correspondent of *The Times* says there is to be no general strike in Paris on May 1st this year. At a meeting of the trade unionists of the Seine Department recently the "principle" of a general strike was adopted, but at the same time the delegates of the railwaymen and transport workers announced that their men would not cease work. Gas and electricity workers and men in the public services will also work as usual.

Weekly Wage Rates.—Some information with regard to wages is given by Dr. Macnamara (Minister of Labour) in a written reply to a Parliamentary question. He states that, among organised workpeople, the increases since 1914 in weekly rates of wages for full time ranged from about 100 per cent. in a few cases to over 300 per cent. in a few others. The general average is probably in the neighbourhood of 160 per cent. or 170 per cent. It is not practicable to state in detail in what cases reductions in wages have been agreed upon specifically for the purpose of lowering prices and stimulating employment, but reductions of wages were taking place in the railway services, the Civil Service and the woollen and worsted industries, and also in hosiery, civil engineering, vehicle building, and other trades, in accordance with fluctuations in the cost of living. In the iron and steel industries automatic reductions of wages were taking place according to the fall in the selling price of products.—*Machinery Market.*

The Electrical Trades Benevolent Institution.—On Monday last the annual general meeting of the Institution was held at the offices of the Cable Makers' Association. Mr. J. Y. Fletcher, chairman of the Committee of Management, presided, and there was a small attendance of members.

The report of the committee stated that the number of members and subscribers was 306; the total income from contributions for the year was £1,724, including shares given by Mr. E. Manville, M.P. With the receipts from dividends and other sources, the total income was £2,337, compared with £3,445 in 1919 (a year which benefited by two special appeals). After paying grants and expenses, a balance of £2,006 was placed to capital account. The total amount of the invested funds was £14,356, a sum "obviously far from adequate to meet the demands for pensions which are certain to be made in the near future." Assistance has been given to every qualified person who has applied for it. The situation of the labour market will doubtless lead to a far larger number of grants being necessary this year. Local advisory committees are in full working order in Cardiff, Glasgow, Manchester, and Newcastle-on-Tyne, and are doing splendid work for the Institution; it is hoped that during 1921 similar committees will be formed in Birmingham, Leeds, and Liverpool. The number of collectors shows a gratifying increase, due to the operations of the local advisory committees, but there is still an insufficient number working on the staffs of firms; the committee appeals to the heads of firms to encourage members of their staffs to become members of the Institution, and to induce one member of the staff to undertake the collection of the subscriptions. Only those who have been members for five or more years, or their widows and children, are qualified to apply for pensions. Mr. E. Manville presided over the annual festival on December 15th, and his appeal resulted in a collection of £1,137. He was ably supported by the vice-presidents, Mr. Ll. B. Atkinson and Mr. W. O. Smith.

The chairman remarked that printing, stationery, and postage expenses had been £128, compared with £86 in the previous year; secretarial and office expenses were less—£146, compared with £171. The secretary was now acting in an honorary capacity. The result of the annual festival differed little from the previous year, but other subscriptions (£306) showed a falling-off compared with £638 in the previous year, and other donations, £350, compared with £1,041. The previous year benefited by a legacy of £100. The total income from investments was £613. Six grants were made, compared with four in the previous year. The annual festival this year, to be held on October 26th, would be presided over by Mr. Ll. B. Atkinson.

The report and accounts were adopted, and the members of the committee who retired by rotation were re-elected *en bloc*, together with Mr. J. H. Farthing, vice-chairman of Manchester and District Local Committee, and Mr. A. H. Allen. In view of the death of Mr. T. E. Gatehouse, a vote of condolence with his family and the ELECTRICAL REVIEW, Ltd., was passed. Hearty thanks were tendered to the hon. secretary, Mr. F. B. O. Hawes, for his valuable services in the past, and for his willingness to continue to do the work of the Institution. The hon. auditors were re-elected, and votes of thanks were accorded to the hon. solicitors, the Press, the chairman, and the Cable Makers' Association. Rule 10, clause (*c*), and Rule 11, clause (*d*), were amended to provide for the case of local advisory committees, and a confirmatory meeting will be held on June 27th.

France's Reclaimed Coal Pits.—The Anzin mines, in the North of France, noted for their extremely deep shafts, were reported on April 21st to have been pumped free of water. During the war period the Germans destroyed all the pumping gear as well as the shaft fittings. After the shafts had been partially repaired, new electrically-driven pumps had to be taken down several hundred feet in order to reach the water in the more distant galleries.—*Evening News.*

Service Notes.—The big battle cruiser *Inflexible* which took such a prominent part in the Battle of Jutland, and in the Dardanelles—in the course of which she was severely strained—is to be sold out of the service. The *Inflexible* was the first battle cruiser fitted with electrically-driven big gun turrets. Lieut. H. Bellman, Glamorganshire Fortress Engineers (Electric Lights Company) has relinquished his commission, but retains his rank. A number of Territorial officers who served with Electric Lights Companies during the Great War, have been appointed to the Reserve of Officers on relinquishing their commissions.

E.P.E.A. Meeting.—On April 20th a meeting was held at Newcastle, under the auspices of the Electrical Power Engineers' Association. The chair was taken by Mr. J. N. Waite, and Messrs. P. S. Thompson and G. W. Essex also spoke. It was mentioned that the Association now had over 4,000 members, 500 of whom were in Newcastle and district.

Railway Electrification.—The manager of the London and North-Western Railway Co., in a paper to the Manchester Statistical Society, on April 21st, remarked that the country was on the threshold of great electrical development, and that the electrification of railways would give a great stimulus to a national system of electrical power production.

INSTITUTION NOTES.

Institution of Electrical Engineers.—Members of the Institution and others will be glad to hear that the work of redecorating the Institution building is being rapidly proceeded with, and that there is every prospect that the Institution will be reinstated, at least on the ground floor, by the middle of May.

The following nominations for election as ordinary members of Council (which are additional to those already made by the Council) have been received :—Lieut.-Col. F. A. Cortez-Leigh, T.D., R.E., nominated by Messrs. O. H. Baldwin, S. W. Baynes, J. H. Bowden, G. Broughall, R. H. Houghton, C. Jones, H. W. Jones, P. V. McMahon, E. T. Ruthven Murray, L. L. Murray, C. W. Neele, P. J. Pybus, C.B.E., P. Rosling, A. M. Sillar, W. J. Thorrowgood, and A. H. Walton. Mr. W. C. P. Tapper, nominated by Messrs. A. W. Blake, F. A. Bond, E. Calvert, A. C. Cramb, F. W. Purse, L. L. Robinson, C. N. Russell, A. H. Shaw, C. N. Staniland, and W. C. Ullman.

Benevolent Fund.—In our issue of December 24th we announced that Mr. E. M. Hughman, of Bombay, had offered a donation of £250 to the Benevolent Fund of the Institution of Electrical Engineers, on condition that 19 similar donations were received. The offer expires on June 30th, 1921. The Committee charged with raising the fund has obtained Mr. Hughman's consent to the sums of £250 not being contributed solely by single donors, but by group subscriptions. The Territorial Centres of the Institution are taking steps to organise such group collections, which will doubtless be supported by members of the Institution of all classes. The Secretary of the Institution of Electrical Engineers, 1, Albemarle Street, London, W. 1, will reply to any inquiries on this subject.

Summer Meeting.—Up to the present 288 names have been received, including 87 ladies. A circular giving details of the arrangements has been received from the Secretary as we go to press.

North Midland Territorial Centre.—The committee of this Centre has circulated a letter in support of the nomination as an ordinary member of the Council of the Institution, of Mr. Thos. Roles, city electrical engineer, Bradford. The committee feels that Mr. Roles would be a very desirable addition to the Council of the Institution, on account of his personal qualifications and his very active services to the Institution and to the North Midland Territorial Centre. Mr. Roles was recently chairman of the Yorkshire Electricity Supply Linking-up Committee, and is the immediate Past-President of the Incorporated Municipal Electrical Association. He is at present a member of the Council and Executive Committee of the British Electrical Development Association, a member of the British Engineering Standards Association, representing the I.M.E.A., and a member of the Joint Committee of the B.E.A.M.A. and the I.M.E.A., for dealing with matters of interest to the two Associations. We may add that he is one of the most popular, as well as efficient, members of the Institution, and can be relied upon to say what he thinks and to "play the game."

Junior Institution of Engineers.—Under the auspices of the Junior Institution of Engineers, a paper upon industrial electric lighting was read recently by Mr. N. Thornton, A.M.I.E.E., at Newcastle-on-Tyne. Mr. Thornton complained that many electric lighting installations were carried out in a haphazard manner, questions of design and the efficient use of lights being disregarded.

Faraday Society.—Physico-Chemical Problems Relating to the Soil.—The Faraday Society is organising a general discussion on the above subject to take place during the afternoon and evening of May 31st next in the rooms of the Chemical Society, London, which will be presided over by Sir A. Daniel Hall, K.C.B., F.R.S., chief scientific adviser to the Board of Agriculture. The discussion will be opened by Dr. E. J. Russell, F.R.S., director of the Rothamsted Experimental Station, who will generally survey the subject. A series of papers dealing with soil moisture, organic constituents, absorption and colloidal phenomena will then be put forward as a basis for discussion. It is expected that among those present will be Prof. Sven Oden, of the University of Upsala. Further particulars of the meeting may be obtained from the Secretary of the Faraday Society, 10, Essex Street, London, W.C. 2.

Institute of Metals.—At a meeting of the Sheffield Centre, on April 15th, Mr. H. A. Greaves, one of the inventors of the Greaves-Etchell steel-melting furnace, read a paper describing a new type of electric furnace for non-ferrous metals. After a survey of the principal existing types, the author said that the outstanding feature of the new furnace was a permanent resistance supported directly above the metal. This arrangement, it was claimed, was far more efficient than if the heat had to be reflected from the walls and roof of the furnace. Of course, in the arc furnace the heat was directed down upon the metal, but in that type the volatilisation of the metal and the damage to the furnace walls were greater.

Gosport Rotary Club.—On April 14th, Captain W. H. Upton Marshall, R.E. (T.), M.I.E.E., delivered a lecture to the members of this Club, upon "Electricity." The lecturer explained the provisions of the Electricity (Supply) Act of 1919, and gave an indication of the improvements aimed at by its application to various parts of the country. Portsmouth's position in connection with the scheme was explained, and the lecturer briefly outlined the history of the electricity undertaking. He said that he understood that Gosport was taking a supply for lighting from the Tramways Co. He considered that unsatisfactory—a better arrangement would be to take a bulk supply from a large supply station.

Edinburgh Electrical Society.—On April 22nd, Mr. James Plucknett, A.M.I.E.E., gave a very interesting lecture on "Relay Automatic Telephones."

The lecturer explained the apparatus in full, and the general lines on which it worked, and finally took his audience through a maze of connections, showing what happened from the time a caller took off his receiver until it was again replaced, and he stated that he pinned his faith on the relay system on account of the entire absence of complicated moving parts. Subsequently, an adjournment was made to inspect the Relay Exchange which Mr. Plucknett's firm has recently fitted in an Edinburgh office. This was the first installation of the kind in the East of Scotland. During the course of the evening it was mentioned that the Relay Co. had 10 exchanges on hand for India, and its first thousand line exchange for the British Post Office was in course of completion at Fleetwood.

Manchester Wireless Society.—On April 5th Mr. Alexander Marr (the Vice-President) read a paper on "The History of the Telephone." The lecturer sketched the history of the development of the telephone from the time of its invention by Prof. Alexander Graham Bell up to the present day.

On April 6th, by the courtesy of the North-Western Section of the Institution of Electrical Engineers, members of the Society were enabled to hear a lecture by Prof. Marchant on "Recent Developments in Wireless Telegraphy."

On April 9th a very successful whist drive and dance was held at the headquarters, nearly 100 members and friends being present.

Chief Technical Assistants' Association.—The annual dinner of the Association was held on April 16th, Mr. J. R. J. Bowden, A.M.Inst.C.E., presiding. A number of visitors attended, and the opportunity was taken to present to Mr. and Mrs. J. H. Parker (a former chairman of the C.T.A.A. and Past-President of the E.P.E.A.), a handsome solid silver tea and coffee service as a token of esteem and appreciation from the C.T.A.A. for their devoted efforts in the interests of the technical staffs. The musical entertainment was of a high order, and provided again by Mr. W. E. Bradshaw, of Islington, ably supported by Messrs. Ricketts and Young; a most enjoyable evening was spent.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. E. Guthrie Bowers, electrical engineer to Messrs. Bruntons, of Musselburgh, is to sail to-day, April 29th, to take up the appointment of assistant mechanical and electrical superintendent to the Bombay Port Trust.

Messrs. E. J. P. Benn and Frank Elliott, representing the Industrial League and Council, have left for the United States to convey fraternal greetings to similar organisations on that side of the Atlantic, and to study in the big industrial centres the problem of re-adjustment of wages, in view of falling prices, and steps for the re-establishment of overseas trade.

Mr. F. Freshwater, who has retired from the position of manager of the Teesside Tramways, Stockton-on-Tees, upon the municipalisation of the system, has been presented by the staff with a gold-mounted walking stick and a wallet of notes, together with a gold brooch for Mrs. Freshwater.

Mr. C. E. Allsopp, of the Bradford Corporation Electricity Department, was elected, last week, as president of the Bradford Engineering Society.

Mr. J. G. Richardson, telegraph superintendent, Edinburgh, was the recipient of an illuminated address and a Georgian silver tea service from the Edinburgh Telegraph Department, at a conversazione on Saturday evening, on the occasion of his retirement.

Limerick Corporation has appointed **Mr. F. Flynn** acting electrical engineer, with **Mr. Grund** as assistant.

Mr. Campbell, who is retiring from the position of borough engineer at Huddersfield, after 23 years' service in that capacity, to take up private practice, was presented last week by Mr. Jagger, deputy engineer, with an electric reading lamp, from the office staff, and a dispatch case from the workmen of the Highways and Tramways Permanent-Way Departments.

Mr. H. J. Skinner, assistant distributing engineer in the Hackney Borough Council electricity department, has resigned his position.

Prof. Einstein has accepted an invitation from King's College, London, to lecture at the College in May.

Mr. A. B. Cartland, of 3, Creechurch Lane, Leadenhall Street, London, E.C. 3, has been appointed sole representative for London and South Counties for Messrs. Wm. Whittaker (Burnley), Ltd., boiler furnace manufacturers, and Messrs. The "Premier" Appliances Co., Ltd., boiler expansion joints.

We understand that **Mr. J. H. Wild, M.I.E.E.**, for many years with the Lancashire Dynamo and Motor Co., Ltd., of Trafford Park, and since 1916 assistant superintendent of electrical manufactures to Vickers, Ltd., has left the latter firm, and joined the board of Nathan & Allen, Ltd., of Westminster. **Mr. E. P. Lucking**, who has been closely associated with the firm of Nathan & Allen for seven years, has also joined the board of the new company.

Obituary.—Mr. John Aitchison.—The death took place on April 17th, at Chalmer's Hospital, Edinburgh, of Mr. John Aitchison, who, from the time the installation was put down, had held the position of electrician at Floors Castle, Kelso.

Will.—The late Mr. C. A. Barrett (of the Hoffmann Manufacturing Co., Ltd., Chelmsford), left £413,106 net personalty.

NEW COMPANIES REGISTERED.

Olivers, Electro-Platers, Ltd. (174,314).—Private company. Registered April 20th. Capital, £2,000 in £1 shares. To carry on the business of electrical and mechanical engineers, electricians, engineers, and contractors, manufacturers of electric apparatus, electro platers, electrotypers and stereotypers, polishers, electro depositors, enamellers and lacquerers, metal refiners, motor car, boat, omnibus, van, and carriage proprietors, &c., and to adopt an agreement with H. D. Oliver. The first directors are: H. D. Oliver (managing director), 42, South Market Road, Great Yarmouth; G. Richardson, Braehead, Bonhill, Dumbartonshire; G. E. Wolsey, Westwood, Southtown, Great Yarmouth; S. R. Woodger, Gable End, Marine Parade, Great Yarmouth; H. Williment, 31, Regent Street, Great Yarmouth. Secretary: H. Williment. Registered office: 42, South Market Road, Great Yarmouth.

J. H. Humphrey, Ltd. (174,271).—Private company. Registered April 18th. Capital, £1,000 in £1 shares. To adopt an agreement with J. H. Humphrey, of 5, High Fold Lane, Uttley, Keighley, for the acquisition of the business of an electrical engineer carried on by him. The permanent directors are: F. J. Cowie, 62, Duckworth Terrace, Bradford, engineer; J. H. Humphrey, 5, High Fold Lane, Utley, Keighley, electrical engineer; S. Barraclough, 22, Duckworth Terrace, Bradford, engineer. Qualification: 50 shares. Secretary: W. G. Hunt. Registered office: Downham Street, Bradford.

Bromford, Ltd. (174,255).—Registered April 16th. Capital, £500,000 in £1 shares (250,000 preference). To carry on the business of manufacturers of and dealers in metal tubes, conduit tubes, and other kinds of fittings for electric wiring, and all apparatus, articles, and accessories used in connection with the erection and fitting up of electrical installations, metal rollers, wire drawers, steel makers, ironmasters, electrical, mechanical, hydraulic and general engineers, &c. The minimum subscription upon which the directors may proceed to allotment is 5,000 shares. The first directors are: J. H. Aston, Beaudesert Park, Henley-in-Arden; J. Baker, The Grange, South Road, Smethwick, near Birmingham; G. Beesley, The Pump House, Barnt Green, Birmingham; J. Rollason, Hampton Manor, Hampton-in-Arden. Qualification: £500. Remuneration of chairman: £300 per annum; of other directors (except managing director): £200 per annum. Solicitors: Pinsent & Co., 6, Bennetts Hill, Birmingham. No notice of situation of registered office was filed at time of incorporation.

John Collier & Co. (Electrical Engineers), Ltd. (174,260).—Private company. Registered April 16th. Capital, £20,000 in £1 shares (12,000 "A" and 8,000 "B"). To take over the business of an electrical engineer carried on by J. Collier at 29, King Street West, Manchester. The first directors are: J. Collier, Pullwyke, Ambleside (permanent); J. Ratcliffe, 72, High Lane, Chorlton-cum-Hardy, Manchester; W. T. Reynolds, 26, Delaunays Road, Higher Crumpsall, Manchester. Qualification: 1,000 shares. Registered office: 29, King Street West, Manchester.

Nathan & Allen, Ltd. (174,343).—Private company. Registered April 21st. Capital, £10,000 in £1 shares. To take over the practice of Nathan & Allen, electrical engineers, of 25, Victoria Street, S.W. The first directors are: F. B. Nathan, 14, Charleville Mansions, W.14; J. H. Wild, Nantwych, St. Botolphs Road, Worthing; F. S. Allen, 20, Grey Coat Gardens, Westminster; E. P. Lucking, 15, Chatsworth Gardens, Acton, W.3. Qualification: 150 shares. Registered office: 25, Victoria Street, S.W.1.

Woodaloid, Ltd. (174,326).—Private company. Registered April 20th. Capital, £1,000 in 900 participating preferred shares of £1 each, and 2,000 deferred shares of 1s. each. To carry on the business of mechanical or electrical engineers, pattern makers, founders, workers in wood and wood substitutes, hardware manufacturers, &c. The first directors are: A. B. Shaw, 252, South Norwood Hill, S.E. 25; S. J. Rouse, 2, Tanfield Court, Temple, E.C.; W. R. Gaff, 7, Rusham Road, Wandsworth Common, S.W. Registered office: 2, Tanfield Court, Temple, E.C.

Indurit Products Co., Ltd. (11,695).—Private company. Registered in Edinburgh April 16th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of "Indurit" and other electrical, insulating, and moulding materials. The first directors are: W. Hunter, 4a, St. Andrew Square, Edinburgh, technical consultant; R. Howden, 50, Leamington Terrace, Edinburgh, gentleman; J. H. Fairgrieve, Cherry Cottage, Uddingston, analytical chemist; W. Grant, Broomknowe, Mossend, engineer; D. W. Cowe, 1, Park Place, Trinity, Leith, gentleman. Qualification: 50 shares. Secretary: H. Howden. Registered office: 4a, St. Andrew Square, Edinburgh.

Particulars of the **Electrolytic Zinc Co. of Australasia, Ltd.**, have been filed pursuant to Section 274 of the Companies (Consolidation) Act, 1908. The capital is £3,000,000 in £1 shares (1,500,000 8 per cent. cumulative preference and 1,500,000 ordinary). A private company was incorporated in Victoria, Australia, on June 2nd, 1916, as the "Electrolytic Zinc Co. of Australia Proprietary, Ltd.," to quarry, crush, smelt, calcine, refine, dress and amalgamate, manipulate electrolytically or otherwise, and prepare for market, ores, metals, fluxes, tailings, concentrates, slimes, mineral substances, and other products of mines in Australia or elsewhere. It was resolved on September 6th, 1920, that the word "proprietary" be omitted from the title, and that the company be converted into a public company. The British address is at Pinners Hall, Austin Friars, E.C., where A. J. Smith is authorised to accept services of process and notices. The directors are: Hon. W. L. Baillieu, T. B. Birkbeck, M. Cohen, A. J. F. de Bavay, C. Fraser, W. M. Hyndman, B. Kelly, G. C. Klug, H. A. Sheppard, Hon. G. Swinburne, J. L. Wharton, and W. S. Robinson, all of Melbourne; G. W. W. MacKinnon, 24, Evelyn Gardens, S.W.7; F. A. Govett, Holiday House, Sunningdale, near Ascot; and G. G. Hay (as alternate to F. A. Govett), 18, Stonebridge Park, Willesden, N.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Sun Electrical Co., Ltd.—Satisfaction to the extent of £275 on April 11th, 1921, of debenture stock dated March 31st, 1911, securing £7,000.

Lancashire Ordnance Accessories Co., Ltd.—Particulars of £50,000 debentures authorised July 16th, 1920, whole amount issued (registered April 14th, 1921, pursuant to Order of Court). Property charged: Company's undertaking and property, present and future, except uncalled capital.

Quead, Ltd.—Satisfaction to the extent of £2,000 on March 31st, 1921, of debentures dated November 29th, 1920, securing £5,000.

Uxbridge & District Electric Supply Co., Ltd.—Mortgage dated April 5th, 1921, to secure £1,000, charged on certain land and premises in Hillingdon West, Middlesex. Holder: E. J. Garner, 118, High Street, Uxbridge.

Cammell Laird & Co., Ltd.—Conveyance dated March 31st, 1921 (supplemental to trust deeds dated March 22nd, 1905, and July 9th, 1901, to secure £500,000 4½ per cent. debenture stock and £1,000,000 5 per cent. debenture stock). Charged on certain land and premises at Penistone, Yorks. Trustees: Rt. Hon. Lord Stuart of Wortley, 7, Cheyne Walk, Chelsea, S.W., and A. Tongue, 13, St. Ann Street, Manchester. Also conveyance dated March 30th, 1921 (supplemental to trust deed dated January 1st, 1914, securing £500,000 5 per cent. first mortgage debenture stock), charged on above-mentioned properties. Trustees: Law Debenture Corporation, Ltd., 24, Old Broad Street, E.C.

London Electric Wire Co. & Smiths, Ltd. (101,353).—Return dated March 25th, 1921. Capital, £1,250,000 in 750,000 ordinary and 500,000 preference shares of £1 each, 644,070 ordinary and 400,000 preference shares taken up, £35,035 paid, £694,035 considered as paid. Mortgages and charges: Nil.

Northampton Electric Light & Power Co., Ltd. (28,640).—Return dated March 9th, 1921. Capital, £250,000 in 10 "A," 212,601 "B" ordinary, and 37,399 "B" preference shares of £1 each, all issued and fully paid-up in cash. Mortgages and charges: £71,625.

CITY NOTES.

Urban Electric Supply Co., Ltd.

The annual general meeting of this company was held on April 20th at Winchester House, Old Broad Street, Mr. P. D. Tuckett presiding. In proposing the adoption of the report, the chairman said that the results for the past year, although they showed a substantial improvement over those of the previous 12 months, were still far from being satisfactory. They had now a connected load 70 per cent. larger than in 1914, and nearly 90 per cent. larger than in 1913, when they were paying the preference dividend with every prospect of an ordinary dividend in the near future; yet, instead of deriving a more than equivalent increase of profit from that increased load, they were to-day, after making the increased depreciation provision which the enhanced cost of renewals now called for, actually deprived of any return on their share capital. Before the war the total working costs were about £80,000. Last year they exceeded £280,000, an increase over 1919 of £60,000, of which the increased price of coal and the increased rate of wage accounted for nearly £50,000. Until confidence was restored, and a commercial equilibrium established between costs and revenue, there could be no active development, and certainly no prospect of a cheap or abundant supply, so far as their small isolated undertakings were concerned. If with current costs and rates of charge they were denied the right to earn an adequate return on their pre-war capital, how was it possible for them to extend the business by the expenditure of further capital on plant and mains costing nearly three times as much and with capital costing nearly twice as much? Even if the expenditure would enable them to secure some reduction of their generating costs, the capital charges would render it prohibitive. Thus, at a time when there was every prospect of an increasing demand for electricity, they had no alternative but to reverse their progressive policy so as to avoid at all costs any development involving capital expenditure. Their customers were bound to suffer, but until costs fell or the Government faced the facts and provided an appropriate remedy, the difficulty would remain. However much consumers might want a supply, and however anxious they might be to give it them, it was commercially impracticable for them to face the cost.

At present they were compelled to charge some consumers more than they should, because they were prevented from charging others as much as they should, for there was this very marked and important difference between maximum rates now and before the war. Then they were maximum rates in fact, with a sufficient margin over the rates actually charged. To-day they were in practice minimum rates with less than no margin. He believed the whole system of control by maximum rates was wrong. Either they were high enough to be inoperative as before the war, or by their inadequacy as at present they ran counter to every economic law and so destroyed the very basis on which the development of the business depended. Small undertakings like theirs had suffered much more severely than the larger ones. He would explain the main differences affecting them, and he could do so the more readily because he was a director of the City of London Electric Lighting Co., which was one of the most successful of the larger undertakings. Apart from summer-time and early shop closing, which had generally deprived the smaller undertakings of a disproportionately large proportion of their comparatively small revenue, thereby raising both their capital and working costs per unit, they had been hit twice as hard as the larger undertakings by the increased price of coal and the increased rates of wage, without having been able to compensate themselves by making percentage increases in their rates of charge to the same extent that the larger undertakings had been able to do; and in this connection they must bear in mind that coal, wages, and salaries represent over 80 per cent. of their working costs. A large undertaking, using large turbine generating sets, consumed some 2 to 3 lb. of coal per unit, whereas this company, with their small reciprocating sets, could not expect to consume much less than 5 lb. or 6 lb. per unit. The increased price of coal hit them, therefore, twice as hard as it hit the others. Then, as to wages. Before the war in their small country towns the class of labour and supervision they employed was very different to that employed in the great cities and large industrial centres. The nature of their business compelled them to run their stations cheaply, and as a rule their men under the easier and pleasanter conditions were content to work longer hours at a considerably lower wage. But now that wages and working hours were regulated by Joint Industrial Councils on a more or less uniform standard throughout the country, it had had the effect of increasing wage rates altogether disproportionately, besides compelling them in some cases to employ an additional shift. To take a hypothetical example, where the City Co. were paying £2 before the war, the Urban Co. were paying little more than £1 for a corresponding service, so that, although they might now be paying £5 against the Urban £3 10s., their wages bill was increased 150 per cent. where this company's was increased 250 per cent. With regard to the question of compensating price, before the war the average lighting rate of the City Co. was little more than 3d. per unit, whilst they were generally charging from 5d. to 6d., but whereas the City Co. had been able to follow their rising costs by corresponding increases of price, until they were now charging 8d. per unit, thanks to their 8d. maximum rate having afforded them an ample margin, the Urban Co., whose costs were altogether disproportionately increased, had only recently been allowed to charge up to 10d. per unit in half their undertakings and up to 1s. per unit in the remainder, their original maximum rates of 7d. and 8d. having afforded them no similar adequate margin within which to adjust their prices. In other words, the City Co., with doubled costs, had been free to more than double its price, whereas this company with trebled costs had been condemned to starve for three years and could now barely double theirs. He was not saying that 10d. and 1s. might not appear fairly high rates compared with those charged by large undertakings or those to which recently they had been restricted, but they were not high in relation to the costs which had been imposed on the company, nor would they appear high if they had been allowed gradually to advance them contemporaneously with their rising costs. Turning to the Electricity (Supply) (No. 2) Bill, the speaker said: "What fate awaits it I am unable to say, but it is certainly ill-calculated to restore confidence to a sorely tried industry, and I shall be much surprised if it does not meet with strenuous opposition. Should its controversial provisions lead to its rejection or withdrawal, I do not know what steps may be taken to ensure the grant of the enlarged powers in regard to prices which the welfare of the industry makes it so vital for the Ministry of Transport to possess, but until their powers are enlarged I see little prospect of our obtaining further relief so far as maximum rates are concerned. In these times we must no doubt all expect to suffer, but I see no justification whatever for subjecting our small undertakings to the impossible conditions under which we are compelled to work them and at the same time arbitrarily denying us the right to meet those conditions, so far as it might be possible for us to do so, in the same way that every untramelled industry has been free to do, and has been obliged to do. . . . It would be well for you not to lose sight of the fact that the capital value of our plant has largely increased, that the underlying basis of the business is essentially stable, and that we consequently only require fair trading conditions to enable us to earn a reasonable return." Proceeding to refer to the accounts, Mr. Tuckett said that in the net profit and loss account there was a substantial increase in the interest charges, due to the increased capital expenditure which they had been forced to incur during the past two years in making good the war-time arrears, whilst their increased earnings had involved them in an additional income tax charge of £6,500, leaving them with a net balance of £25,840, as compared with £7,606 a year ago. He was afraid the shareholders would feel some disappointment at the directors' inability to recommend the resumption of a preference dividend, but, despite the substantial improvement shown, the company's financial position rendered it impossible for them to deplete their cash resources at the present time. Owing to their inability to adjust their rates of charge to their constantly rising costs, he estimated that they had been deprived during the past few years of something not far short of £150,000, which would have been available for the payment of dividends and for meeting their other current financial needs. As it was, all their available resources had been absorbed in providing the additional working capital which their higher working costs now entailed or were required to meet such current capital expenditure as their statutory obligations inevitably compelled them to incur. Regarding the future, the outlook for the current year was by no means assured. They were doing all they could to reduce their working costs, but with over 80 per cent. of the total represented by coal, wages, and salaries, over which they had a very limited control, it was not easy to effect any large reduction independently of the general reduction which they all hoped to see before long. The only other means of improving the position was by increasing the revenue. They could not do that by active development involving capital expenditure, and, except in one case which was now pending, they were of opinion that it would be inopportune and futile to press for a further increase in their selling rates until they knew the fate of the Bill now before Parliament under which the Ministry of Transport was seeking enlarged powers.

Mr. E. Charrington seconded the motion, and the report was adopted.

Automatic Telephone Manufacturing Co., Ltd.

Mr. J. Taylor, presiding at the annual meeting, held at Liverpool on April 19th, said that the profit for the year was £15,369, plus £9,341 brought forward. Depreciation, preference dividend, and other outgoings having been paid, there remained a balance of £6,861 to be carried forward. It was not possible to pay a dividend on the ordinary shares. With regard to the agreement made in March, 1920, with the International Automatic Telephone Co. for the promotion of sales of the Strowger automatic telephone in colonial and foreign territories, this alliance was undoubtedly proving successful, and would be justified. The directors' efforts had been chiefly concentrated on the arrangement necessary to cope with a larger volume of business, and this had involved the expenditure of a large amount of money, which had not shown any immediate profit-earning result. The first fruits were, however, manifesting themselves in valuable orders received from Japan, India, South America, and elsewhere, and many large telephone administrations had finally decided that for economic reasons the advantage of automatic over manual telephones was already beyond dispute. This company had found it necessary to very largely increase its engineering and manufacturing capacity. As the expense involved was for development purposes, which should favourably reflect on future business, they had decided to charge only two-thirds to the 1920 account, the balance being charged to a development account. During 1920 they had to do a considerable amount of reorganisation and construction work, which had temporarily militated against their earning capacity, but such work was necessary, and the directors had every confidence in the results provided the workpeople did not prejudice by adherence to a policy of limited output the company's ability to meet foreign competition, and provided also that general international business was of a normal character. A hopeful feature was the company's railway signalling department, because when released from Government control the railways of the country would necessarily have to spend money in improvements, and from the opinions expressed by railway engineers on the different devices introduced by the company it would appear that a fair share of the business should be secured. Finally, the speaker expressed the belief that the results of 1920 were better in fact than would appear from the balance sheet; time would prove this to be so.

Mr. D. Sinclair, managing director, seconded the adoption of the report, and it was carried.

Metropolitan-Vickers Electrical Co., Ltd.

Mr. J. Annan Bryce (chairman) presided on April 20th over the twenty-first annual general meeting of the company. The chairman, in moving the adoption of the report, first commented on the accounts, and pointed out that the capital now stood at £2,395,000, viz., £1,135,650 ordinary shares, £1,234,370 preference shares, and £25,000 deferred shares. The prior lien debentures continued to diminish in amount with increased rapidity, owing to the operation of the sinking fund, and last year £10,900 was extinguished. "Sundry creditors and credit balances" showed the large increase of nearly £1,200,000. This item included reserve for income tax, corporation tax, and excess profits tax, but the increase was mainly caused by the large amounts due to suppliers of material owing to the

great increase in the turnover. The general reserve account had been increased by the appropriation of £100,000. The balance carried forward was increased by nearly £8,000. On the credit side of the balance sheet no alteration had been made under the heading "patents, goodwill, &c." "Works, machinery, &c.," had risen by, roughly, £100,000, owing mainly to additions to buildings, machinery, and plant., depreciation amounting to £68,000, and a large expenditure on maintenance, having been written off as usual. "Stock and materials on hand" showed the large increase of £1,140,000, caused by the greater volume of business. Special care had been taken to value on a conservative basis, and every effort was made to keep purchases of material as low as possible. "Sundry debtors and debit balances" also showed the large increase of over £800,000 due to the same cause, much greater volume of business. "Cash in hand and at bankers" stood at about £60,000 less than last year. "Sundry investments" were £373,000 less than last year, due to the realisation of short-term securities, the proceeds of which had been applied to meet the needs of the greater volume of business. Coming to the profit and loss account, the gross profit was £81,555, and the net profit £83,231 larger than in 1919. Considering the interruption of business caused by the railway strike and the moulders' strike at the end of 1919, which greatly affected the results of 1920, and were indeed even still to some extent affecting the operations of the current year, they would consider it satisfactory that they were able to appropriate £100,000 to reserve, £35,000 to special depreciation, increase the carry over, and raise the dividend on the ordinary shares from 8 to 12½ per cent. The orders received during 1920 were in value about 80 per cent. greater than those received in 1919, while the orders completed were in value about 50 per cent. greater. The tonnage of orders completed represented an increase of about 30 per cent., a remarkable improvement, in view of the fact that electrical machinery was always becoming lighter in weight owing to the increase of efficiency in the material used in its construction. The increase of tonnage completed, moreover, reflected very great credit on the efficiency of the organisation. Last year he said that there were signs of the recognition by employers of the need for more human sympathy with their workers. He believed the feeling of sympathy was growing every day. It was recognised by every sensible man that the worker should be helped to maintain in part at least the improved standard of living which he enjoyed during the war, and that meant a widening of the pre-war margin between wages and cost of living. When the working day was shortened it was alleged that output would be maintained or increased. So far from that being the result, even the output per man per hour was less, with the result of an immense reduction of output and increase of cost. If the coal question was not settled at once industry would be unable to carry longer the burden of taxation under which it was staggering, a burden so heavy that many great concerns were forced to borrow to pay their taxes; a fact known to every banker, though the Treasury denied it. The excess profits duty had, indeed, made a belated departure, but its extinction would give no relief where no excess profits were being earned. Industry demanded another financial relief—a reduction of the bank rate. There was a further difficulty, the competitton of other countries—America, Belgium, Germany, and France. In none of these countries was the reduction of output per man a feature as it was with them. In America the production per man in almost all the great industries was about three times as great as with this country, and so, though the workman had high wages, and a possibly higher standard of life, the cost of production was lower. The present coal crisis was caused by America underselling us in every Continental country, in spite of the handicaps of a much longer haul to the port of shipment. In Germany unskilled labour got from 14s. to 17s. per week, skilled labour got from 35s. to 42s. per week, and with a ten-hour day. The German exporter was favoured by a very low exchange, and so in almost every article for which he had not to import the raw material he could undersell them by 50 per cent. and make profits up to 50 per cent. A few months ago an English concern had to place a large order for constructional steel. The lowest British tender was one million pounds. A German firm of repute tendered at £550,000 and got the order. Here in England, as long as the recent legislation imposing a 50 per cent. reparation duty is in force, there will be little imported from Germany, but the competition from it would have to be met everywhere except in France, the only other country which had imposed similar legislation. In Belgium and France also exports were favoured by a low exchange, and their labour, especially in Belgium, was working much harder than ours. Unless, therefore, Britain could reduce its costs by an increase in output and greater efficiency and economy in every direction, the outlook for its exports, on which hitherto the prosperity of the country had principally depended, was dark. Especially dark was it so long as the Continental countries remained impoverished. If they kept poor they could not buy from Great Britain. Referring to the workers, the chairman said the number of male workers had increased from 4,013 to 6,594, and women from 778 to 885. In the nine years since 1912 the average weekly earnings of men had increased from £1 7s. 6d. to £3 15s. 10d., and of women from 12s. 3d. to £2 0s. 1d., these figures including boys, girls, and night shifts. In the same period the pay of apprentices had been about trebled. The number of staff was about 2,300, consisting of about 1,550 men and 750 women. Of the latter, many were engaged in work of a highly technical character. A central canteen was opened in January; it seated 2,000 men, and 1,750 had already arranged to purchase their meals at it. A canteen seating 1,500 for the use of the staff would be opened in a few weeks. Three new departments had been started with the view of increasing efficiency and promoting economy. They were called respectively: Production, process, and inspection departments, and the increased efficiency attained had already amply justified their creation. The new research building was already partly occupied, and the rest would soon be ready for occupation. The department was doing most valuable work, not only in testing but in scientific investigation for the purposes of the company and allied concerns. The education department continued to expand. At the end of 1920 it had under training some 1,450 boys and men, of whom 100 were college apprentices of the university graduate type, 100 school apprentices from public and secondary schools, and 800 trade apprentices. A benevolent fund to relieve cases of hardship arising through illness, accident, or other causes of distress among the workpeople had recently been established, and its members already numbered 2,115. The fund would be maintained by an annual subscription from the company, contributions from members, &c. The company had lately taken over the management of the electrical department at Messrs. Vickers' works at Sheffield. This arrangement avoided the necessity of the provision of further buildings and equipment at Manchester, and would in other ways prove of advantage to the company, especially by creating a close co-operation in the manufacture and sale of the products.

Sir F. H. Barker (vice-chairman) seconded the motion.

Mr. Birks asked if the board contemplated renewing the option to the shareholders to convert their preference shares to ordinary shares. The number which had been so converted was rather disappointing, and he thought the operation had been checked by the low price of the shares in the market.

The chairman said the reopening of the question of conversion would want consideration, as it would require an alteration of the articles of association.

The motion was carried.

International Automatic Telephone Co., Ltd.

Mr. D. Sinclair presided at the meeting held at Liverpool on the 19th inst. He said that this was a company holding shares in the Automatic Telephone Manufacturing Co., and was formed as a means of strengthening the whole position. A large number of questions, many of them of an international character, had to be considered, and Mr. Adams and the president of the company, and Mr. Mellinger, a director, were now on the Continent negotiating and arranging matters in the interests of the company, for it was necessary to be in touch with telephone interests in almost all parts of the world. The company had secured and handed over to the Automatic Telephone Manufacturing Co. orders for larger exchanges in South America, Japan, India, and other countries, including an order from Mesopotamia for about £28,000 of equipment. When a country like Mesopotamia could do that it could readily be understood that when the forward countries really took up automatics the field was very large indeed. He expressed the regret of the directors that it had not been possible to pay a dividend for 1920, but it was hoped that the work done and the large amount of money put into the business would in the relatively near future earn profits, which would compensate those who had done the work as well as the shareholders.

A shareholder wanted to know if orders could not be obtained from nearer home than the East.

In reply, Mr. Sinclair said that the British Post Office had not come up to the scratch to the extent that had been expected, but grumbling did not help, and things were now looking better than they did.

North Metropolitan Electric Power Supply Co.

The net revenue for 1920 was £96,175, compared with £62,381 for 1919. Adding the interest and dividends received and the balance brought forward, the total is £103,395. The following are deducted: Mortgage, loan, and debenture interest, £18,700; debenture reserve fund, £2,000; contribution to reserve account, £16,011. Out of the balance of £66,683, a dividend on the 6 per cent. cumulative preference shares is paid requiring £35,999, and a dividend of 7½ per cent. per annum on the ordinary shares absorbs £26,251, leaving £4,433 to carry forward. The total units sold during the year represented an increase of approximately 18 per cent., compared with 1919. As from December 24th, 1920, a supply of electricity in bulk has been given to the Harrow Electric Light and Power Co., Ltd. A bulk supply agreement has been concluded with the Welwyn Garden City, Ltd., for distribution in the Welwyn Garden Estate. Negotiations have been proceeding with the Metropolitan Electric Tramways, Ltd., and the Middlesex County Council for an increase of the rates of supply to the 56 route miles of tramways and light railways operated by the Tramway Co., and a satisfactory arrangement has now been made. The company has obtained judgment in an action against the metropolitan borough of Stoke Newington under the Courts (Emergency Powers) Acts for an annulment of the pre-war supply contracts with the Council. Negotiations are now proceeding with the Council for a continuation

of the supply upon improved terms to the company. The North Metropolitan Electrical Power Distribution Co., Ltd., in which the company is interested, has made satisfactory progress, and is paying an ordinary dividend at the rate of 4 per cent. for 1920. The increased rates authorised by the Ministry of Transport for supply for private purposes were introduced as from the commencement of the midsummer quarter, 1920. Additional generating plant has been installed at the Brimsdown power station, and will be ready for use within the next few months. Extensive alterations and improvements are in progress at this station for the installation of further generating plant, with the consent of the Electricity Commissioners. The consent of the Minister of Transport under the Public Utility Companies (Capital Issues) Act, 1920, has been obtained to the increase of the borrowing powers of the company by the creation and issue of mortgage debentures or debenture stock or the raising of loans to an extent not exceeding one-half the amount of the share capital issued and paid up.

Meeting held April 27th.

French Companies.

The report for the financial year to August 31st, 1920, of Commentry-Fourchambault et Decazeville shows a net profit balance of 5,162,661 fr., or 87,220 fr. above that of the preceding year. This result has been achieved after liquidating 3,208,555 fr. of new works, against 2,070,442 fr. in the year preceding. A dividend of 100 fr. per capital share and 75 fr. per share *de jouissance* is proposed.

The Compagnie Continentale pour la Fabrication des Compteurs à Gaz et autres Appareils is about to issue 10,000 500-franc bonds, at the price of 495 fr., yielding 7 per cent. interest, free of tax, present and future, and repayable in 20 years from February 15th, 1922.

The Société d'Electrochimie et d'Electrométallurgie is issuing bonds to the value of 15,000,000 fr. The bonds are of 500 fr. nominal, bearing 6.5 fr. interest, free of tax, present and future, and are issued at 490 fr. They are repayable in 25 years from 1926, either by drawings or purchase on the market.

An issue of 24,000 500-franc bonds is being made by the Société Electro-Cable, 20,000 of which are allotted to M. Henry Debauge, and 3,400 to Debauge et Cie, as payment for their assets.

The board of the Tramways Electriques de la Rive gauche de Paris has decided to make payment of the balance of the dividends for the years 1918 and 1919 at the rate of 2,725 fr. net to nominative shares, and 2.06 fr. to shares to bearer, against return of coupons.

The report of the Compagnie des grands Travaux de Marseilles shows a profit of 1,454,105 fr., after providing for various sinking funds, allowing of the distribution of a 50 fr. dividend. New and interesting outlets had been opened for electric enterprise in the liberated territory and in Spain, Cilicia, and Argentina. Older undertakings or those under construction were proceeding normally, notwithstanding the financial difficulties of the moment.

Italian Companies.

The Società Tramvie Elettriche Bresciene has increased its capital to 12,000,000 lire, in order to complete the conversion to electric working of the tramways of Bresciana, formerly belonging to the Società Elettrica Bresciana.

The following Italian electric companies have augmented their capital: The Società Idroelettrica del Fasanella, to 500,000 lire; the Società Romana di Elettricità, from 6,000,000 to 30,000,000 lire; the Società Elettrica ed Elettrochimica del Caffaro, from 8,000,000 to 12,000,000 lire; the Società Anonima Guarnierè, of Milan, from 500,000 to 2,000,000 lire; the Società Elettrica Interprovinciale di Verona, from 3,000,000 to 15,000,000 lire; and the Società Adriatica di Elettricità from 60,000,000 to 100,000,000 lire.

The Società Idrolettrica Ligure, of Spezia, as a result of its last working, has decided to write down its capital from 14,910,000 to 7,455,000 lire, and to raise its capital to 25,000,000 lire.

With a capital of 1,000,000 lire has been launched in Rome the Società Italiana Rappresentanze Elettriche (S.I.R.E.) for the representation and trading in electric lamps, heating and lighting apparatus, and other electrotechnical articles.

The Società Idroelettrica Piemontese Lombarda Ernesto Breda, with a capital of 60,000,000 lire, has been established at Milan, for the generating and utilising of water power in general, and especially for the working of the plant on the Lys, constructed during the war by the Società Italiana E. Breda.

The Società Italiana di Elettrochimica, after setting aside 600,000 lire to the sinking fund, 1,155,000 lire to the shareholders at the rate of 7.70 lire per share, and carrying over 5,187 lire, has decided to increase the company's capital to 21,000,000 lire.

The Società Idroelettrica del'Ossola, of Milan, has closed its 1920 account with a net profit of 60,116 lire, the assets of the company being valued at 795,458 lire.

Stock Exchange Notices.—The Committee has specially allowed dealings in the following:—

Electrolytic Zinc Co. of Australia.—1,100,000 cumulative participating preference shares of £1 each (10s. paid).

Indian Electric Supply & Traction Co., Ltd.—The surplus on working in Cawnpore during the year 1920 was £34,970 (against £27,933 in 1919), and including transfer fees, bank interest, and discount on Treasury bills in England, the credit side of net revenue shows a total of £40,597. London expenditure was £2,462 (£2,309 in 1919), and after providing £3,113 for debenture interest, the profit is £34,981, plus £3,803 brought forward. There is put to reserve for depreciation and renewals £6,000; to general reserve £6,500; written off debenture issue expenses, £2,500; written off new share issue expenses £514. The preference dividend for the year requires £7,562. The total distribution on the ordinary shares is 10 per cent. for the year (£9,767); and the directors' commission on the dividend is £342 and £524, leaving £5,075 to carry forward, subject to taxation. Meeting: London, May 4th.

Brush Electrical Engineering Co., Ltd.—The accounts for the year ended December 31st, 1920, show a net profit of £191,096, to which must be added £74,726 brought in from 1919, making a disposable total of £265,822. £13,000 is placed to depreciation account; the expenses of the new issue of ordinary shares made in 1920 amounting to £15,576 are written off; £2,044, being a further 4 per cent. for the year, is paid to the 6 per cent. second prior lien debenture holders; £53,377 added to general reserve, raising this account to £75,000. A dividend of 15 per cent. per annum on the ordinary shares, absorbing £38,557, will be recommended, leaving a balance of £143,368 to be carried forward, subject to E.P.D., income, and corporation profits taxes, and directors' additional remuneration.

Madras Electric Tramways (1904), Ltd.—Gross profit for year ended December, 1920, £41,103. After debiting interest and London office expenses, making provision for debenture stock, sinking fund, and putting £15,000 to depreciation and renewal account, the balance is £15,693, plus £4,944 brought forward. Preference dividend, less income tax, £6,000; 8 per cent., free of tax, on the ordinary shares, £4,580; contribution to employés' gratuity fund, £1,000; to general reserve, £3,500; carrying forward, subject to E.P.D., if any, £5,556. The traffic receipts and running expenses in rupees show increases of 16.6 per cent. and 24.4 per cent. respectively on 1919. The balance from running account shows a considerable increase, but in comparing the figures with the previous years, regard must be had to the par value of the rupee, which was 2s. for 1920, instead of 1s. 4d. as formerly.

Metropolitan Electric Tramways Co.—Revenue for 1920, apart from dividends receivable, amounted to £957,555. Deducting all expenses chargeable to revenue, including debenture and loan interest, and setting aside £10,000 for reconstruction and renewals, there remains £8,424, plus dividend receivable on holding in North Metropolitan Electric Power Supply Co., and sum brought forward, making available £37,406. Directors recommend placing to reserve £10,868; dividend on preference shares, balance of 4¼ per cent. per annum for 1918 and ¼ per cent. per annum on account of 1919, carrying forward £1,538. Benefit of increased fares was only obtained by company during six months of year, while increased working expenses prevailed throughout the whole of the year. Reconstruction of portion of track in Tottenham district was carried out during the year. The Company purchased and cancelled £8,848 4¼ per cent. and £3,962 5 per cent. debenture stock.—*Financial Times.*

British Electric Transformer Co., Ltd.—The report for 1920 states that after paying all manufacturing costs and expenses of administration, the net profit is £70,267, plus £10,523 brought forward, making £80,790. There is to be put to reserve £10,000; to depreciation reserve £3,000; preference dividend absorbs £18,836; dividend of 10 per cent., and a bonus of 2½ per cent. for the year require £40,625; extra remuneration to directors, £2,150; carried forward £6,178. The directors report the death of Mr. F. J. Marchment, a director. Annual meeting: April 29th.

London United Tramways, Ltd.—Gross receipts for 1920 totalled £532,742, an increase of £36,200. Working expenses £482,597. Balance £50,144, compared with deficit of £144 for 1919. After charging debenture and loan interest there is £695 as a deduction from deficit for years 1918 and 1919. The effect of increased fares, says the *Financial Times*, was only felt by the company during part of the year, while the increased working expenses prevailed throughout the whole of the year.

Belgium.—The report of the Société Generale Belge d'Entreprises Electriques, of Brussels, for last year shows a profit of 1,825,787 fr., as compared with only 784,152 fr. in 1919.

The Société des Ateliers de Constructions Electriques de Charleroi reports a profit of 6,719,081 fr. for the past financial year; a dividend at the rate of 5 per cent. is being declared.

Montreal Light, Heat & Power Companies.—A dividend of $1¼ on Montreal Light, Heat & Power consolidated shares and one of $2 on Montreal Light, Heat & Power Co. common shares are announced.

Sweden.—Accumulatorfabriks Aktiebolaget Tudor has decided to increase its share capital from the present 1,000,000 kr. to 2,000,000 kr. by the issue of new shares of 1,000 kr. each at par.—*Reuter's Trade Service* (Stockholm).

British L.M. Ericsson Manufacturing Co., Ltd.—A dividend of 8 per cent., free of tax on the ordinary shares is announced. After putting £10,000 to reserve, £18,721 to depreciation, and paying £13,148 as income tax, &c., £39,094 is to be carried forward, subject to repayment of E.P.D. and payment of corporation tax.

Rhondda Tramways Co., Ltd.—The directors are recommending that there be paid on the preference shares 2 per cent. balance for 1915 and 6 per cent. on account of 1916. It is proposed to convert the 6 per cent. cumulative preference shares into 8 per cent. non-cumulative participating preference shares.

Fairbairn Lawson Combe Barbour, Ltd.—Profit for 1920, after providing for corporation tax and setting up special reserve for other taxation, £206,414, plus £32,982 brought forward. Further dividend of 7 per cent. on ordinary shares, making 10 per cent., and bonus of 5 per cent. (free of tax) on ordinary shares recommended.

Calcutta Electric Supply Corporation, Ltd.—Final dividend for the year 1920 of 6 per cent., making 10 per cent. for the year, with an added bonus of 1 per cent. Both the dividend and the bonus will be paid free of the amount allowed for Indian taxation.

Mexborough & Swinton Tramways Co.—The dividend for 1920 is 2½ per cent., free of tax.

STOCKS AND SHARES.

Tuesday Evening.

The principal item of interest this week in Stock Exchange markets is the effect of the Budget upon prices. Nobody had expected Mr. Chamberlain to introduce anything but a humdrum Budget, so that the presentment of the national accounts surprised nobody in being more or less colourless, except to the unfortunate taxpayer. The Budget frequently has an influence over gilt-edged stocks, and of late years the effect has been, excepting one or two Budgets, to make prices lower. This year, however, the markets for national securities rose sharply on the Chancellor's speech, with its news of a 3½ per cent. conversion loan. The strength of good stocks is well maintained, and further rises have occurred in various Home Railway prior-charge descriptions, including those of the Undergrounds. Both Metropolitan preference and District debenture have gone up during the last few days.

Various improvements have been secured by shares in the electrical manufacturing group. Since the announcement of the English Electric 8 per cent. dividend a steady inquiry has been noticeable for these and kindred shares. The report of the English Electric Co. aroused a little wonder as to whether the directors were altogether wise in making a distribution so substantial at a time like the present. But the shares have risen 2s. to 14s. 6d., and the preference are better at 14s. Siemens hardened to 22s. 6d., Electric Constructions to 16s. 3d., Edison Swan ordinary gained a florin at 12s., and Cromptons at 15s. are 1/16 up. The North Metropolitan Electric Power Supply Co. issues an unexpectedly good report, showing an increase in the net revenue of £34,000 at £96,000. The ordinary dividend goes up from 4½ per cent. to 7½ per cent. The company's business progresses favourably, and agreements for the supply of bulk electricity have been arranged for the Harrow Electric Light Co. and the Welwyn Garden City, Ltd. Upon this, British Electric Traction has advanced 4 points to 30, London and Suburban ordinary picked up to 2s. 3d., and the preference to 5s.

On Friday in this week the River Plate Electricity Co. holds its meeting, at which a dividend of 7 per cent. for the year on the ordinary stock will be declared, making the sixth consecutive year in which this rate has been distributed. The company is a holder of 5 per cent. obligations in the German Trans-Oceanic Electric Co., and these bonds are to be exchanged for an obligation of the Compañia Hispano-Americana de Electricidad, a Spanish Corporation. The report points out that a dividend, of what amount is not stated, has been paid upon the company's shares in the Argentine Electricity Co., Ltd., and that the interest has been met upon the 5 per cent. debentures held in the Tucuman Tramways Co.

Babcock & Wilcox are 1/16 up at 2⅞. In spite of the public's manifest disposition to buy fixed-interest stocks and shares, there is still some demand for ordinary issues in which scope exists for capital appreciation when trade settles down into more normal channels. Vickers have risen to 14s. 3d. on hopes of a 5 per cent. dividend. The tax-free preference now stand at the same price.

The cable market is firm throughout. The Eastern group resumes its steady improvement. There are small rises in Western Telegraphs, Eastern Extensions and Eastern Telegraph ordinary. The floating amount of stock available for buyers is small, and any stock which comes in finds a ready home. Cuba Submarines are again 10s. higher at 7½. Marconi's advanced to 2½, and, in point of fact, have been still better. No little discussion is going on as to what the next dividend is likely to be. The optimists pin their hopes to a substantial Government grant for compensation, while, on the other hand, some point out that it may be as well to qualify exuberant expectation in view of disappointments that have occurred in the past. Marconi preference keep pace with the ordinary, and are 2 7/16. Canadians are quoted at 8s.; the Radio shares have scarcely moved.

Metropolitan Electric preference have risen to 3 1/16, and Chelsea ordinary at 3½ are also ⅛ better. The City of London Electric Co.'s 8 per cent. second preferences were left in the hands of the underwriters to the tune of 42 per cent. The ordinary shares offered at 22s. 6d. were all taken by the public. The company's prospectus appeared at as bad a time as could possibly have prevailed for an issue of this sort, and it is not surprising that of the 300,000 preference the underwriters should have to take 127,000. Buyers promptly came into the market, however, and the price rose to 6d. discount after opening lower. The new ordinary are called "par" to 1s. premium, par being the issue price. The new Central Electric 8 per cent. Notes are higher at 2 premium.

Mexico Tramways Fives are 3 up at 40, and Mexican Light & Power Fives gained a further 2½ points at 67, making a rise of 5 in a fortnight. Canadian Generals are lower at 120, and so are Brazilian Tractions at 34. Home Railways became somewhat dull, because of the coal strike. Nevertheless, the Budget speech carried a crumb of consolation to proprietors of the stocks; the Chancellor referred to the possible claims upon his surplus that might arise in respect of liabilities to the railways, under the war agreements. In the rubber market there is no change from the stagnant conditions that must prevail while the price of the raw produce remains so flat.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1919.	Dividend 1920.	Price April 26, 1921.	Rise or fall.	Yield. p.c.
Brompton Ordinary	12	12	6	—	£10 0 0
Charing Cross Ordinary	7	8	8⅝	—	10 6 6
do. do. 4½ Pref.	4½	4½	7⅞	—	7 16 6
Chelsea	4	6	8½	+ ⅛	9 12 0
City of London	13	14	23/3	—	12 0 10
do. do. 6 per cent. Pref.	6	6	17/-	—	7 1 2
County of London	8	8	7⅞	—	10 9 10
do. do. 6 per cent. Pref.	6	6	8	—	7 10 0
Kensington Ordinary	7	9	4½	—	10 18 2
London Electric	2½	2½	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	2⅞	—	10 18 2
Metropolitan	6	7	3½	—	10 15 4
do. 4½ per cent. Pref.	4½	4½	3 1/16	+ ⅛	7 7 0
St. James' and Pall Mall	12	12	6	—	10 0 0
South London	6	—	2½	—	9 2 10
South Metropolitan Pref.	7	7	15/9	—	8 17 10
Westminster Ordinary	10	10	5½	—	9 15 2

Telegraphs and Telephones.

	1918	1919			
Anglo-Am. Tel. Pref.	6	6	78½	—	7 12 10
do. Def.	33/6	1½	15½	—	9 10 6
Chile Telephone	8	6	5½	—	8 6 8
Cuba Sub. Ord.	7	7	7½	+ ⅛	9 6 8
Eastern Extension	10	10	16½	+ ⅛	6 4 0
Eastern Tel. Ord.	8	10	16½	+1½	6 8 10
Globe Tel. and T. Ord.	8	10	16	—	6 5 0
do. do. Pref.	6	6	9	—	6 13 4
Great Northern Tel.	22	22	22	—	10 0 0
Indo-European	13	10	30	—	8 6 8
Marconi	25	25	2½	+ 1/16	—
Oriental Telephone Ord.	10	12	2 1/16	—	*5 9 7
United R. Plate Tel.	8	8	6⅛	—	6 10 8
West India and Panama	1/8	Nil	1/16	—	Nil.
Western Telegraph	8	10	16⅛	+ ⅛	*6 4 0

Home Rails.

	1919	1920			
Central London Ord. Assented	4	4	44½	—	9 0 0
Metropolitan	1½	1½	25	—	6 0 0
do. District	Nil	Nil	14½	—	Nil
Underground Electric Ordinary	Nil	Nil	2	—	Nil
do. do. "A"	Nil	Nil	6/-	—	Nil
do. do. Income	4	2	71½	—1	2 16 0

Foreign Trams, &c.

	1918	1919			
Anglo-Arg. Trams, First Pref.	Nil	5½	2⅝	—	10 9
do. do. 2nd Pref.	Nil	Nil	3	—	Nil
do. do. 5 % Deb.	5	5	59½	—	8 8 0
Brazil Tractions	Nil	Nil	34	—2	Nil
British Columbia Elec. Rly. Pfce.	5	5	55	—	9 1 10
do. do. Preferred	2½	5	84½	—	*8 14 0
do. do. Deferred	Nil	8	51½	—	*11 17 6
do. do. Deb.	4½	4½	68½	+1	7 5 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	40	+3	Nil
do. 6 per cent. Bonds	Nil	Nil	27½	—	Nil
Mexican Light Common	Nil	Nil	11½	—	Nil
do. Pref.	Nil	Nil	18	—	Nil
do. 1st Bonds	Nil	Nil	67	+2½	Nil

Manufacturing Companies.

Babcock & Wilcox	15	15	2⅞	+ 1/16	6 6 4
British Aluminium Ord.	10	10	16/3xd	—	12 6 2
British Insulated Ord.	12½	15	1⅝	—	9 12 0
Callenders	25	15	1⅞	—	10 18 2
do. 6½ Pref.	6½	6½	17/6	—	7 8 7
Crompton Ord.	10	10	15/-	+ 1/16	13 6 8
Edison-Swan	10	10	12/-	+2/-	—
do. do. 5 per cent. Deb.	5	5	70	—	7 2 10
Electric Construction	10	10	16/3	+6d.	13 6 0
English Electric	—	8	14/6	+2/-	11 0 8
Do. Pref.	—	6	14/-	+1/-	8 11 6
Gen. Elec. Pref.	6½	6½	19/-	+6d.	6 16 10
do. Ord.	10	10	24/6	+ 1/16	*8 8 6
Henley	25	15	1⅜	—	11 8 6
do. 4½ Pref.	4½	4½	9⅛	—	6 18 6
India Rubber	10	10	⅜	—	—
Met.-Vickers Pref.	—	8	14⅜	—	9 2 10
Siemens Ord.	10	10	11⅝	+ 1/16	*8 17 10
Telegraph Con.	20	20	20	—	*5 19 9

* Dividends paid free of Income Tax.

AUTOMATIC CABLE PROTECTIVE GEAR.

The Ferranti-Hawkins System.

The Ferranti-Hawkins system of cable protection (Ferranti-Hawkins-Hanstock patent, 1919) which has recently been placed upon the market by Messrs. Ferranti, Ltd., may be described as a combination of the Merz-Price and Ferranti-Feld systems of protection; its chief utility lies in its application to the protection of feeder cables, although it may be employed to protect apparatus of other kinds. It is suitable for use on a.c. systems from which, in the event of a breakdown of insulation, a current will flow to earth through the fault, and by its use it is claimed that perfect discrimination is obtained between sound and faulty apparatus, so that only the latter is disconnected. The chief advantages claimed for the gear are its freedom from accidental operation, simplicity, and the absence of parts subject to high pressure.

Component Parts.—On referring to the diagram of connections (fig. 1), it will be seen that the cable to be protected is threaded through a special core-balancing current transformer at each end of the feeder requiring protection, the secondary circuits of the current transformers being taken through relay coils and pilot wires in a manner similar to that adopted in the Merz-Price system of protection.

The transformer (fig. 3), as applied to a three-phase cable, is shown diagrammatically by fig. 4; its core surrounds all three cores of the main cable, which thus forms the primary winding, and a secondary winding encircles the core and is connected to the relay. The vector sum of the load currents in the three cores of a healthy three-phase cable is zero at every instant whether the load is balanced or not, and under normal conditions, therefore, no flux is induced in the transformer core, and consequently no current in the secondary winding. But on the occurrence of a fault current to earth the vector sum no longer equals zero, and a flux *a b c d* (fig. 4), is induced in the core, thus producing a current in the secondary winding which actuates the relay.

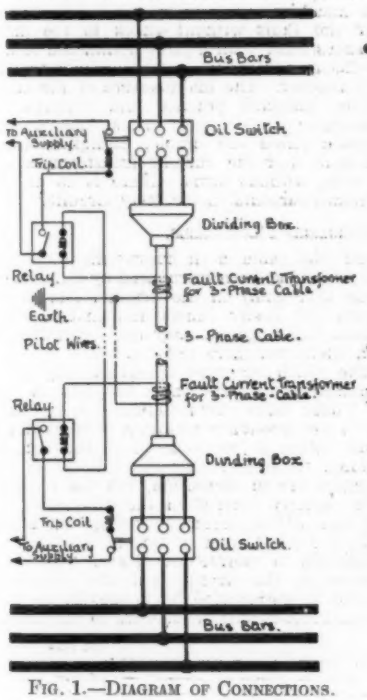


Fig. 1.—Diagram of Connections.

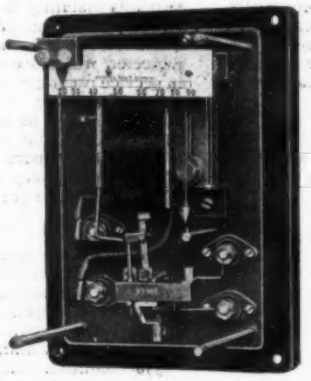


Fig. 2.—Relay with Cover Removed.

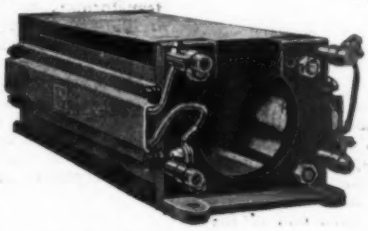


Fig. 3.—Transformer.

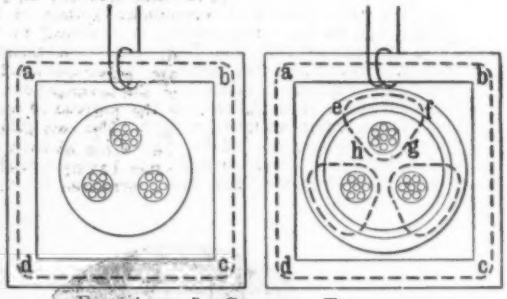
To ensure that the secondary winding shall not be affected by the magnetism due to the currents in individual conductors it is sometimes necessary to surround the cable with an inner magnetic shield as shown in fig. 5. It is not considered safe for the transformer core to be in contact with the insulation of the cable; the transformer can, therefore, be fitted with a pair of porcelain insulators and a Pertinax tube.

The relay is illustrated by fig. 2, and consists of an electro-magnet excited by current from the secondary winding of the transformer. The armature of the magnet is controlled by a sliding weight which can be adjusted according to a scale marked in amperes of fault current. A single-pole switch is mounted beneath the magnet, and when the armature is attracted to the latter it overbalances the switch blade, which thereupon falls into a contact and closes the trip circuit of the main switch. After operation the switch is reset by hand in the "off" position by raising a knob which projects beneath the case. The relay must be mounted in a truly vertical position, and a plumb bob is provided to ensure that being done.

When the transformer is used with lead-covered or armoured cable it is important that the earthing of the lead covering and armour be carefully considered, otherwise the satisfactory operation of the apparatus may be interfered with. The best method is to bond the lead covering and armouring to the cable box and to connect an earth wire from the cable box through the transformer to the main earth bar, as shown in fig. 6. The cable box must be lightly insulated from any supporting earthed framework.

The three chief advantages claimed for the protective method under consideration are:—

(*a*) *Freedom from any tendency towards accidental operation.*—In the first place, in the Merz-Price system the current transformers are connected in the individual phases so that the iron circuit of each transformer has a flux induced in it, and by means of the opposition of the secondary windings of the current transformers at the two ends of the protected cable the flux is prevented from causing any secondary current to circulate through the pilot wires and the relay coils. The current transformers may have very similar characteristics, and give precisely similar terminal voltages at normal loads, but still differ sufficiently to produce a current in the secondary circuit under short-circuit conditions, and it is possible that this current may be of sufficient magnitude to operate the relays. This tendency is entirely absent in the Ferranti-Hawkins system, since it may be assumed that even under short-circuit conditions the algebraical sum of the currents in the three phases of the cable or cables which pass through the current transformers will be zero and, therefore, no flux will be induced in the iron circuits of the current transformers.



Figs. 4 and 5.—Cable and Transformers.

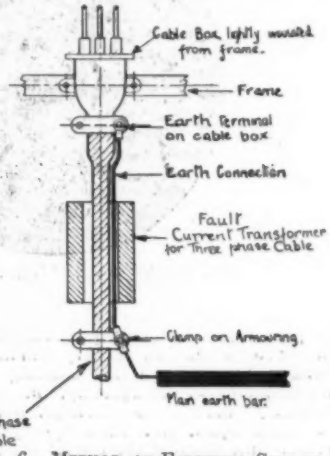


Fig. 6.—Method of Earthing Sheath.

In the second place, in the ordinary Merz-Price system, so long as there is any load on the circuit protected, each current transformer will tend to send a current through the pilot wires and relay circuit, and if an accidental short circuit occurs between the cores of the pilot cable or the connections thereto at any point, the current will immediately flow through the relay coils, thus causing the operation of the protective gear, although no fault exists on the protected cable, which operation will lead to a shut-down of part of the system. With the system under review, since under normal conditions the current transformers do not tend to supply any secondary current, an accidental short circuit on the pilot circuit will not cause operation of the gear.

(*b*) *Simplicity.*—A comparison will show that instead of employing three current transformers and three relay elements at each end of every cable to be protected, the above-described system employs only one current transformer and one relay element at each end of the protected circuit. Further, in the case of a single cable being protected, the system only requires two pilot cables against three, and for the case where

several cables are laid in parallel, each cable will require one pilot wire with an additional pilot wire common to all the cables to provide a common return.

(c) *Absence of high-pressure apparatus.*—With regard to the third advantage claimed, it is obvious that it is not necessary to install current transformers insulated for the supply voltage; those used slip over the cable outside any sheathing or armouring which may be used, no special insulation of any kind being required. Apart from other obvious advantages, this fact means that the current transformers can be examined or tested at any time without risk and without its being necessary to shut down any part of the electrical installation.

The protection afforded by the Ferranti-Hawkins system in practice is said to be quite as adequate as that afforded by other systems. The only fault conditions under which operation would not be obtained would be those which are obtained when a short circuit occurs between phases without a simultaneous fault to earth. This condition, however, is assumed to be so very improbable that it may safely be neglected. The sensitivity of the gear is at least as great as that of other patterns, and its operation can readily be obtained with a fault current of 50 amperes to earth under the worst possible conditions, or an even lighter setting could be given if it was found to be desirable to do so.

"Kalecore" Cable.

This is an improved form of cable specially adapted for use with the Merz-Hunter split-conductor system of feeder protection, and as its name implies, is produced by Callender's Cable and Construction Co., Ltd. Fig. 7 illustrates an 11,000-volt, 0.15 sq. in., 6-core, 3-phase, paper-insulated and lead-sheathed "Kalecore" cable, and the arrangement of connections by which it is utilised for the purpose of automatically protecting a feeder is shown in fig. 8. The two split conductors forming one phase are led to the switch at each end of the feeder through a current transformer having a double primary winding, the two windings being arranged in opposition so

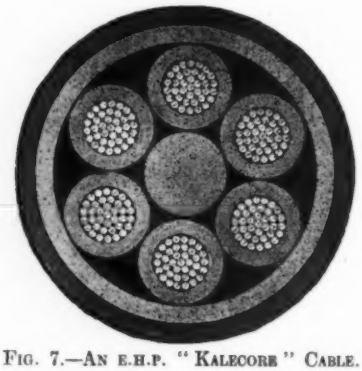


Fig. 7.—An e.h.p. "Kalecore" Cable.

that, so long as there are equal currents in the two conductors, the effects of the two primary windings are opposed, and no current flows through the secondary winding of the current transformer and, consequently, the relay is inoperative. Immediately there is any leakage, however, the currents are no longer equal, and the relays operate at each end of the feeder, thus opening the circuit breakers.

The two conductors, or splits, forming each phase are situated at opposite ends of a diameter in the "Kalecore" cable (in other forms of split-conductor protection they are adjacent to each other) and the arrangement of conductors, it is claimed, avoids the possible danger that a fault on one split might spread to the other split of the same phase, and thus tend to prevent operation of the automatic device by developing equal faults on both splits. In actual fact, the tendency of a fault on one split, if it spreads, is to damage adjacent conductors which are the splits of the other two phases; the effect of a spreading fault in the "Kalecore" cable is, therefore, to bring into action the relays of all phases of the cable.

The diametrical arrangement of split conductors also ensures that there will be no inductive out-of-balance between the splits of any phase, which is important, because it avoids unnecessary tripping of the switches. The two currents in the split conductors of each phase divide according to the relative impedance of the splits, and precise equality of impedance cannot be secured; there will always be some slight difference, although it may be only a fraction of 1 per cent., and if it is not kept small, the automatic gear may tend to operate on momentary overloads (even when the feeder is not faulty), but the "Kalecore" construction of cable, due to the similarity of the conductors and their symmetrical arrangement, secures extremely close equality of the splits, thus allowing the relays to be adjusted to respond to extremely small fault currents and, at the same time, to be unresponsive to the heaviest overloads. When a dead short circuit occurs at the delivery end of the feeder and full bus-bar pressure is maintained at the generating end, the current in the feeder is limited solely by the feeder impedance, and will generally reach a value of several thousand amperes, depending on the size and length of the feeder. The "Kalecore" system will withstand, it is claimed, even these severe conditions and, at the same time, will respond instantly to fault currents of a few amperes only.

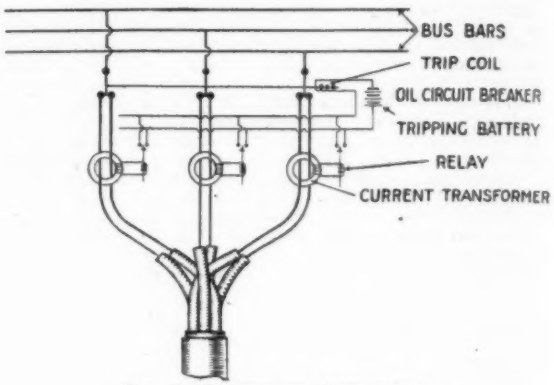


Fig. 8.—Diagram of Connections

The following advantages are claimed for the system: It responds instantly to small leakages and isolates faulty feeders at the inception of the fault without shock to the main system; no circumstances other than a fault within the feeder protected will cause the gear to operate, and it cannot remain in service wrongly connected. The manufacture of the cable is no departure from standard practice and requires no auxiliaries such as metallic shields, pilot wires, shaped conductors, &c. The cable joints are simple, straightforward, of standard construction, and the current transformers are of the bar primary type, without turns. There is no danger of access of high-pressure currents to the relay circuits.

Screened Pilot Cable.

The use of screened pilot cable is an improvement (Beard-Hunter patent, 1917, which has been introduced by Callender's Cable & Construction Co., Ltd.) on the original Merz-Price protective arrangement for feeder cables and makes, it is claimed, the apparatus safer against improper operation on heavy overloads and, therefore, more reliable.

The condition under which improper operation may occur is an overload amounting to many times the normal full load of the feeder. Under these circumstances a fairly large voltage is generated in the secondary windings of the current transformers, as this voltage is proportional to the current in the primary winding. It is true that the voltages of the two current transformers are in opposition, but the pressure is free to produce a capacity current in the pilot cable insulation, and in the case of long feeders carrying very heavy momentary overloads, the pilot capacity current produced in this way may be sufficient to operate the relays. This difficulty has been overcome by the arrangement now described. Each core of the pilot is surrounded by a sheath, so that all the capacity current must flow from the core to the sheath.

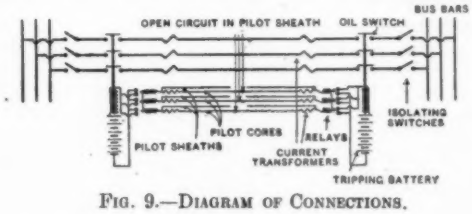


Fig. 9.—Diagram of Connections.

The sheath is connected to the current-transformer secondary winding in such a way that the capacity current circulates in the circuit composed of the pilot core, sheath, and current-transformer secondary winding. As a result the capacity current is entirely diverted from the relay, and the system becomes immune from operation on heavy overloads.

The diagram, fig. 9, shows the complete arrangement of connections to comply with the above description, and a drawing showing in cross-section the 3-core screened pilot cable used for this purpose is given in fig. 10. A section of a combined pilot and telephone cable is shown in fig. 11, illustrating the manner in which telephone communication can be very cheaply provided by incorporating the cores in the pilot cable, and the following comments in connection with the apparatus composing the system will be of assistance to those installing and using it.

A quick-acting oil switch is in practice found to be advantageous, as faults are removed without shock to the general

electrical system. Switches which complete their opening in as short a time as one-twentieth of a second are used, and the tendency is to use even quicker switches, the mechanism of which should be proof against sticking and rusting.

On the design and construction of the current transformers depends more than anything else the successful operation of this system. It is obvious that the two current transformers opposing each other at each end of a feeder must have precisely similar characteristics, and it is necessary for them to produce an exact balance. Moreover, this condition of balance must hold for all the values of current which may be carried by the feeder while it is sound. For instance, a fault on some other apparatus on the system may momentarily pass through the feeder a current amounting to as much as 50 times the normal full load. In fact, absolute safety is only ensured when the current transformers will balance with the largest current which can possibly pass through the feeder. This current may be calculated by dividing the voltage of the circuit by the impedance of the feeder. It is preferable to use current transformers in which the primary winding consists simply of a copper bar without turns, and in order to keep down the secondary voltage on heavy currents, the core of the current transformer usually contains an air gap.

It is advisable not to use too complicated, too delicate, or too sensitive a relay; one which will operate with the secondary current produced by a feeder leakage of 50 amperes is sufficiently sensitive for practical requirements. In the case of relays which are not self-resetting the battery is left

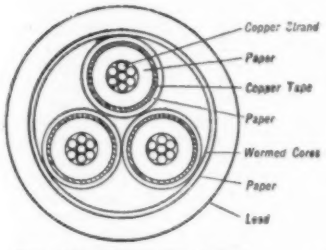


Fig. 10.—Screened 3-core Pilot Cable.

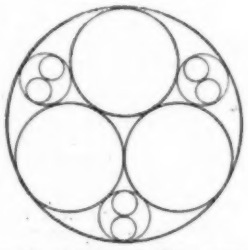


Fig. 11.—Combined Pilot and Telephone Cable.

connected to the tripping coil after the switch has operated, and there is risk of the battery being exhausted; therefore, an auxiliary switch should be provided on the oil-switch mechanism which will open the battery circuit when the oil switch is open. Self-resetting relays avoid this complication, but they do not make such reliable and definite contact as the other type.

If the switch trip coil requires 15 volts to operate it, it is advisable to use a primary battery giving not less than 25 volts to allow for bad condition of the tripping mechanism and a partially run-down battery. Schemes for avoiding the use of batteries and utilising l.p. a.c. for tripping the switches are, generally, unsatisfactory, because the switches have really to be tripped only when there is a fault on the feeder, and at such times the a.c. pressure is liable to fall momentarily much below its normal value. The only really reliable course is, therefore, to provide a tripping supply quite independent of the main circuits, *i.e.*, a small secondary battery.

It must not be overlooked that the protective apparatus operates only for feeder faults, and faults on the switchgear, busbars, and other apparatus would not be switched off if the system contained nothing but feeder protective gear. To meet this condition overload relays may be used, but care must be taken that they will not operate before the protective relays. The protective relay should be instantaneous in its action, and the switch which it controls should not take more than one-fifth of a second, as a maximum, to open the circuit. If, therefore, the overload relays will ignore overloads which do not last for half a second or longer, the protective gear will always have time to remove the fault before the overload relays come into action. Provided this precaution is taken, overload relays may be used quite freely on feeders, the general guiding principle being that a busbar fault in any particular sub-station should shut down as small an area as possible.

New Socket for Electrical Line Posts.—M. Vernholes, a French engineer, has designed a new socket for supporting the wooden posts of electrical transmission lines, which he has patented and called "AVA," says the *Revue Générale de l'Electricité*. The socket is very simple and light, constructed of reinforced concrete, easy to transport and install, and does not comprise any ironwork or bolts. It is made up of four vertical side-pieces strongly connected together at the top, bottom, and middle. The lower part is buried in the soil, the middle being to level, and the upper part supports the foot of the post, which is firmly fixed to it at about one foot above the ground. It can be fitted to posts of any diameter. —*Technical Review.*

THE TESTING AND APPROVAL OF ELECTRICAL APPLIANCES IN ONTARIO.

We have received from the Department of Overseas Trade a copy of a memorandum prepared by Mr. W. P. Dobson, laboratory engineer, Hydro-Electric Power Commission of Ontario, which is reproduced below:—

In the elimination of fire and accident hazards from electrical installations two closely related but separate features are involved. One of these has to do with the method of installation, and necessitates a visual examination of the completed work to detect hazards due to improper or careless methods. The other feature is supplementary to this, and is concerned with the quality and condition of the materials and apparatus employed. It involves careful tests under standard conditions which are not usually obtainable except in a laboratory. This feature of electrical inspection may be designated approval testing as distinct from the first feature or field inspection. Approval testing is the function of the Approval Laboratory of the Commission.

In the early days of the Electrical Inspection Department the work of approval was carried on by that department in conjunction with field inspection. Devices and materials which bore the label of Underwriters' Laboratories of the United States were accepted as satisfactory in any installation. Much material, however, continually appeared on the market, which had not been approved by the underwriters' laboratories, and such material was examined and approved by the Electrical Inspection Department. Labels were distributed to manufacturers for use with certain types of goods, such as service boxes, motor starters, and electric signs. The number and variety of devices and materials appearing on the market increased so rapidly that it was found impossible for the Inspection Department to carry on both approval and field inspection, especially in cases where laboratory tests were necessary. Accordingly, in 1917 the approval testing was turned over to the Laboratories Department of the Commission, and a section was organised to carry on the work under the name of the Approval Laboratory.

Scope of Work.—The scope of the work is indicated by the wording of the announcement made by the Commission at the time of the organisation of the Approval Laboratory. This reads as follows:—

Pursuant to Power Commission Act, 6 Geo. V., Chapter 19, Section 10, 1916, and amendments thereto, and the Rules and Regulations of the Hydro-Electric Power Commission, covering the design and construction of electrical machinery, apparatus, appliances, devices, material, and equipment for use in the generation, transmission, distribution, or use of electrical power or energy in the Province of Ontario, in connection with any electrical installation or wiring for electric light, heat, or power, where the electric pressure delivered to or from the same exceeds 10 volts, manufacturers of, jobbers, agents, and dealers in, electrical machinery, apparatus, appliances, devices, material, and equipment, and others interested are hereby notified that the Commission orders that, on and after three months from date of this notice, no such electrical machinery, apparatus, appliances, devices, material, or equipment used or to be used as above may be used, offered for sale, or disposed of in the Province of Ontario unless and until the design and construction of same has been submitted to the Hydro-Electric Power Commission of Ontario and approval of such has formally been obtained.

(This notice was published in Ontario on January 17th, 1918.)

While any device designed to operate on a circuit of over 10 volts comes within the jurisdiction of the Approval Laboratory, the work of approval testing has been confined chiefly to devices rated at 600 volts or less; special attention being given to those classes of appliances which are sold to the public for unrestricted use.

The following incomplete list will indicate the diversity of devices and materials which have been submitted for approval and tested in the Laboratory:—

Wires for electric ranges, earthing clamps, conduit and conduit fittings, enclosed motor starting switches, switch boxes, electric signs, cabinets and cut-out boxes, panel boards, high-frequency generators, electrically operated pumps, rectifiers, sockets, receptacles, lamp shades, lamp fixtures and fittings, wire connectors, air heaters, pressing irons, automobile heaters, cooking appliances such as ranges, toasters, and grills, elevator switches, farm lighting plants, oil-break switches, plug and cartridge fuses (renewable and non-renewable), current taps, cut-out bases, rosettes, bell-ringing transformers, electrical soldering tools, soldering lugs, insulating devices, outlet bushings and fittings, auto-starters, washing machines, oil and gasoline pumping outfits, elevator controllers.

Method of Procedure.—It is incumbent upon the manufacturer to obtain approval of the design and construction of his product before offering it for sale in Ontario. To obtain this approval, the device in question is sent to the laboratories accompanied by a formal application to the Commission. The necessary tests are then carried out, and the manufacturer is advised of the changes, if any, which are necessary to bring the device up to standard. It is sometimes necessary to submit two or more samples before one is produced which

is in accord with the requirements. When a device has finally been constructed which is considered by the Laboratory to be free from fire and accident hazard, a report is prepared describing in detail the construction of the device, the tests which were made upon it, and a recommendation that it be approved.

Approvals Committee.—This report is submitted to each member of a committee composed of representatives of the Hydro-Electric Power Commission, the electrical manufacturers, dealers, jobbers, and professional societies, and the fire underwriters.

The personnel of this committee is as follows:—

W. P. Dobson, chairman; A. S. L. Barnes, secretary; W. C. Cale, Approval Laboratory; Wills Maclachlan, L. G. Ireland, R. T. Jenery, E. M. Wood, J. F. S. Madden, Hydro-Electric Power Commission; A. G. Hall, Electrical Inspection Department, Hydro-Electric Power Commission, J. A. McKay, representing Canadian Association of Manufacturers of Electrical Supplies; C. E. Schwenger, representing Association of Municipal Electrical Utilities of Ontario; O. V. Anderson, representing Canadian Electrical Association; S. A. Gaskell, representing Canadian Association of British Manufacturers and British Electrical and Allied Manufacturers' Association; C. H. Carlisle, representing Canadian Manufacturers' Association; Joseph Rogers, representing Canadian Electrical Supply Jobbers' Association; K. A. McIntyre, representing Ontario Association of Electrical Dealers and Contractors; F. R. Ewart, representing Toronto Section, American Institute of Electrical Engineers; William Taylor, representing Associated Boards of Trade of Ontario; R. Driscoll, representing Canadian Fire Underwriters' Association.

Each member of this committee is asked to read the laboratory reports and signify his approval or disapproval. When agreement among the members of the committee has been reached, the report is presented to the Commission with the recommendation that the device in question be approved for use in Ontario.

When the recommendation has been sanctioned by the Commission the manufacturer is so advised, and an "approval number" is issued, which serves to identify the particular device or line of devices approved. A card index of approved devices is distributed to the district inspectors of the Commission, and to others interested. This forms a continuous record for the use of the inspectors, and contains sufficient information to enable them to identify any approved device which may be brought to their notice.

Re-examination.—When a device has been approved, the manufacturer enters into an agreement with the Commission to manufacture all future devices in exact duplicate of the sample approved. The Commission agrees to allow its name to be placed upon the device, together with the approval number mentioned above, thus signifying that it has passed the necessary tests. This is usually accomplished by placing on the name plate the abbreviation "H.E.P.C. App. No. —." On certain devices, such as enclosed switches, cabinets, conduit, fuses, &c., labels are used. These are furnished by the Commission, and are affixed by the manufacturer.

In order to keep a check on the quality of the product of any factory, periodic tests are made in the laboratory on samples selected in the factory or purchased in the open market. A representative of the Laboratory also visits the manufacturers to examine their product and render them assistance in any matter relating to approval.

By this means it is possible to keep a continuous check upon the various classes of electrical devices and to detect cases of hazardous construction.

Although the majority of the manufacturers making use of the Laboratory are located in Ontario, its services have been made use of by other Canadian manufacturers and by a considerable number of American manufacturers, whose goods have not been submitted for approval to Underwriters' Laboratories. Many of these manufacturers, however, have obtained the underwriters' approval, and in such cases their goods are listed in the records of the Commission upon payment of the cost of listing, provided they also conform to the requirements of the inspection department. It is necessary, however, that all such goods be so listed before being distributed in Ontario.

Standards.—All tests on devices and materials submitted are made with reference to standards where such exist. These are specifications of the various features of construction considered necessary to minimise fire and accident hazard, and of the tests necessary to determine how the specifications have been complied with. The standards in general use in America are those based upon the National Code of the United States prepared by the National Board of Fire Underwriters, in co-operation with electrical manufacturers, inspection authorities, and other interested bodies. These follow standards of construction and wiring in use in the United States and generally adopted throughout Canada.

The standards adopted by the Commission at the inception of the work agree in all essential details with those of the Underwriters' Laboratories in so far as they relate to the fire hazard, but conform to the rules and regulations of the Commission for inside electrical installations where these differ from the National Electrical Code. These differences deal chiefly with the elimination of danger to persons from shock, a feature of inspection which until recently has not been emphasised by the underwriters.

The preparation of standards must of necessity lag somewhat behind the progress of manufacture, hence, standards are not yet available covering all classes of devices on the market.

Standards for the following materials and devices have been promulgated by the Commission: Rubber-covered wire and cable, armoured cords and cable, cartridge enclosed fuses, snap switches, cabinets and cut-out boxes, electric signs, panel boards, knife switches, cut-out bases, soldering lugs, flexible cords, ground clamps.

These standards specify in detail the various features which are considered worthy of attention from the viewpoint of safe construction, such as clearance between live parts and ground and between points of opposite polarity, thickness of metal, current density, &c. They also specify dimensions of various devices such as fuses, cut-out bases, screw shells, &c. Many devices are submitted for approval, however, for which no specific standards exist. Consequently the Commission has, with the co-operation of the manufacturer and other interested parties, prepared standards for certain classes of materials and devices, as such were found necessary. Those prepared to date are: Electric washing machines, enclosed switches, electric ranges.

Much assistance is rendered the Laboratory by the Inspection Department in reporting cases of sub-standard construction, and in obtaining market samples for laboratory examination. The various organisations represented on the Approvals Committee also co-operate in the criticism of laboratory reports and, in particular, the Canadian Associated Manufacturers of Electrical Supplies in the work of preparing standards.

The importance of the approval testing work need not be emphasised. There are several self-evident facts, however, the full significance of which may not be universally realised, even by the electrical fraternity. The approval testing has been referred to as supplementary to field inspection. It is in reality of fundamental importance to the latter, since safe methods of installation are of no avail without properly constructed appliances and materials. The importance of the work to the safety of the public and of property cannot be over emphasised. The fire loss from electrical causes is still large. The danger to life even in low-voltage appliances has not been wholly removed. Consequently continued vigilance in the construction of materials and appliances is an essential feature contributing towards safety in the use of electricity. The growth in the use of electricity by the public at large will depend on safe construction of appliances as much as upon economy and convenience. It is therefore incumbent upon all who are interested in furthering the use of electricity to co-operate in the maintenance of safe standards of construction.

THE LONG-DISTANCE TELEPHONE SYSTEM OF THE UNITED KINGDOM.

Discussion at Manchester.

Members of the North-Western Centre of the Institution of Electrical Engineers discussed Sir W. Noble's paper on the above subject, which was abstracted in our issue of April 1st, on March 22nd, when Mr. J. Frith presided and Mr. A. D. Hart deputised for Sir W. Noble.

Mr. W. J. Medlyn said that the author had compared gutta-percha insulated conductors and the newer paper-insulated lead-covered cables from the point of view of efficiency in speech transmission, but another point of very great importance was the cost. Apart from the additional duct space required, the average cost per line in the older type of cable was so great that its extensive use would have been a heavy financial burden tending to retard the natural development of the service.

Regarding traffic development since the trunk lines were taken over by the Post Office in 1896, the first record showed that during the year ending March 31st, 1898, there were 5,888,274 trunk calls; eight years later that number had increased to 18 millions, and by 1913 the latter figure was doubled, making 36 millions, whilst the latest published statistics for March, 1915, showed that the total had risen to 40,587,833, and provision was being made for a big increase on the last-mentioned total during the next few years. A complete network of cables already existed between all the South Lancashire towns, including Manchester and Liverpool, and extending north as far as Preston and Burnley, and also into Yorkshire. They had faith in the development of the system, because they knew that substantial progress in overtaking the arrears had already been achieved. One of the most important improvements was the increase in facilities for intercommunication between the main centres of industry, and in most cases a call originating in Manchester could now be put through almost on demand to the principal towns in South and Mid-Lancashire. There were now 132 lines working in existing cables between Manchester and Liverpool, and a new cable carrying 160 additional lines was nearly completed; the work of laying a new cable between Manchester and Oldham was also well advanced, and additional lines between Manchester and London would be available in the course of a few months, and a repeater station in Manchester would work in connection with that cable. Other extensions were in hand

which would relieve them of the anxiety of maintaining the service and would give a more stable, secure, and regular service.

Mr. T. E. Herbert thought that the development of the work of cable balancing initiated by Messrs. Tremain and Martin to its present-day form constituted a most remarkable achievement. It was a source of wonder that such delicate tests of such extreme accuracy were made on the roadside by means of the specially equipped motor van. The details of the apparatus, together with an account of the principles involved and detailed instructions for the organisation of such work, would shortly be available. The completion of the vast schemes necessary to obtain the full benefit of all the work done necessarily took time. The supplies of raw materials and their conversion into lines and apparatus had thrown a huge burden on the manufacturers, and in Lancashire it was not difficult to appreciate what they had and were doing to provide the requisite supplies. For obvious reasons the precise financial effect of the various developments sketched in the paper had not been dealt with, but that aspect of the subject was constantly under review, and the economies effected were as remarkable as the scientific achievements. The thermionic valve appeared to have solved most of their problems, but they were only at the beginning of its development, and possibly the receiver microphone relay might have to be rescued from the scrap heap to enable trunk circuits to be separated electrically from the lines of varying length to which necessarily they had to be extended. A number of problems resolved themselves into questions of economics, and there were many cases where it was cheaper to provide extra lines or lines of heavier gauge than to provide the auxiliary apparatus necessary with lesser line plant. At the moment such remarks applied to the carrier or wired-wireless system. In its present stage of development it had several limitations, but in future it would be possible to do for the proverbial shilling what would now cost half-a-crown.

Mr. G. S. Wallace said that the first part of the paper provided an opportunity for those concerned with the manufacture of telephone and telegraph cable to voice their views on the problems that had been put to them by the Post Office authorities during the past few years. They were concerned not only with the electrical properties of the cable, but also with its size and mechanical strength, and the cost of special machinery for handling a non-standard type of cable must in certain cases be very heavy. Had the time yet arrived when cable could be manufactured and balanced in the factory on more standard lines than it was at present? Up to a few years ago the difficulty had been to obtain any commercial speech transmission on ordinary standard telephone cable of over forty or fifty miles in length, irrespective of cost, but sooner or later the cost per circuit in the cable itself would be a vital factor. Cable of different designs might give equally satisfactory results in practice, and the cost of manufacture would be reduced and the rate of delivery accelerated the more the principle of standardisation could be adopted.

Mr. T. Plummer referred to fault localisation on long-distance cables as being a very important matter; he had been a sceptic regarding the ability to find those faults, but he now bore testimony that it was possible to do it by the new system of testing. For example, on the cable from Birmingham to Liverpool, by tests at intermediate points made simultaneously, it was possible to locate faults down to a distance of, perhaps, 100 yards. That was a remarkable achievement when it was borne in mind that the faults they were looking for were ones which, on an insulation loss of thousands of megohms per mile, did not amount to a thousand megohms per mile. In those balanced cables the insulation had to be so perfect that it was regarded as being faulty when the insulation resistance fell to 3,000 or 4,000 megohms per mile. The speaker bore witness to the very good working of those cables; they required practically no attention, and one man was able to look after quite a large number of them—a very important point in connection with maintenance. The maintenance cost of the repeater was extremely small. No reference was made in the paper to the ringing arrangement, which was far more difficult to repeat than the speech.

Mr. T. E. Stretch hoped that the paper would not have the result that every time they ran a pair of wires into a rural district the local people would expect the line to be underground.

Mr. A. E. Banks thought it significant that each step towards improved speech transmission and extended means of communication had been accompanied by increased volume of traffic, a sure indication (if indeed any were required) that a definite field existed for still greater development in those directions. Regarding signalling, the method of applying a vibrating reed so as to produce currents of a frequency suitable for transmission by repeaters appeared to be promising.

Mr. J. M. Jackson touched upon maintenance of the underground work; underground cables would break down just as overhead wires did, though not so frequently, and a tribute ought to be paid to the Post Office research engineers for the very good work they had done in devising a system of localising higher resistance faults.

Mr. L. H. Crane, referring to the proposal for a cross-country overhead system on steel towers and the special wayleave powers, if any, that were contemplated in connection therewith, presumed that a special Act of Parliament would be required after the lines of the Acts required for the construction of railways, as the present powers of the Post Office would be quite inadequate. In the repeater circuit, fig. 8, he understood that the up side could not speak at the same time as the down side. If that was correct, would it not in practice lead to trouble in cutting off through both ends endeavouring to speak at the same time? From the size of the filament batteries he understood that the valves were in circuit with the battery permanently, or at least during the day time. Was it not possible to arrange the circuits so that the valves were only in circuit when required, namely, when the line was connected at both ends by either operator or subscriber? Suitable relays could be designed for connecting in the balancing circuit of the repeater shown in fig. 2 to effect that purpose which would also enable automatic calling and clearing signals to be arranged for. Perhaps some form of polarised relay might solve that problem.

Mr. C. E. Morgan understood the application of the four-wire repeater circuit was limited to circuits in the region of 200 miles in length. In connection with the two-wire repeater circuit they could not have a main greater than a cable equivalent to 12. In a number of cases there was a demand in the neighbourhood of 7, 8 or 9, which seemed to mean keeping up the overhead lines.

Mr. A. D. Hart, in replying to the discussion, explained that Sir William Noble's difficulty in drafting the paper was to keep it within reasonable limits. If he had started out to deal with fault localisation, that section alone would have been as big as the paper itself, and a long paper would have been necessary to explain the ringing arrangement. Also Sir William had in mind the fact that those subjects were dealt with in the professional papers of the Institution of Post Office Engineers. The tests made between London and Liverpool were made with a cable which did not contain screened conductors; the cable was of quad formation for some distance out of London and then dropped into twin formation. The multiple twin which they now used was a later development, and another type which had fallen out of use was that known as the quad pair. Martin and Tremain did continue their tests on screened conductors, but not in connection with that cable. There was no difficulty whatever in working valves in series for telephone-repeater working, but the limit was in the cable. The fact that they had to crowd so many conductors into a telephone cable meant that the mutual interference between the neighbouring circuits was a measurable quantity. If they pushed up the amplification for the repeater by adding valves in series, then they increased the mutual interference. Two valves in series were sufficient to give much more than could safely be put into the telephone cable, *i.e.*, in practice the repeaters could be spaced out on an underground cable to about 60 miles apart, sometimes 70. If they were taken beyond that distance the attenuation would be so great that the amplification that would be necessary at the repeater would give serious trouble. Probably the minimum distance over which the four-wire repeater circuit would be used might be four or five miles. For trunk circuits it was rather difficult to give a minimum distance, but certainly with the two-wire repeater, which would be used on the London-Manchester cable, they could cover most of the requirements, because if they could ensure a standard in that current, say, 12 miles corresponding to a reduction ratio between the sending and receiving currents of about 4 to 1, they would be getting a quality of conversation very much better than they could get on many of the circuits at the present time. The current taken by the valve now in use (a sample of which was exhibited) was 0.8 A, and the power expended in the filament was roughly 4 W, which gave an electron emission of about 10 amperes. That gave all they required. They would like a filament that would give that same electron emission for a less expenditure of energy, but the low-wattage valves they had tested up to the present were not entirely suitable for telephone-repeater work. It was absolutely essential that the grid voltage-plate current curve of a valve for telephonic repeater purposes should be an absolutely straight line. The switching-on of valves only when they were wanted obviously meant a complication of relays. They were aware of the necessity for transmitting ringing currents, signalling, calling, and so forth, but the first essential was that they should transmit speech, and any addition to those circuits of automatic means of calling and so on meant complication. A further development, the details of which would be published shortly, was a method of signalling for groups of repeater circuits automatically by means of a device which was familiar to telegraph engineers. Suppose ten circuits between two points which they could not afford to supply with signalling arrangements; they could put a multiplex distributor on the tenth circuit and let it distribute ringing current to each of the others. Manchester was to be a telephone-repeater station, and a very important one apparently because it was a sort of focus for all the long-distance lines in that part of the country, and the Manchester repeater station would grow as the underground cables increased. The speaker did not agree that the microphone repeater might have to be resuscitated.

Radium.—*The Times* states that over £500,000 has been raised in Denmark by a national fund for the purchase of radium.

JAPANESE HYDRO-ELECTRIC AND ELECTRICAL MANUFACTURING WORKS.

Two noteworthy articles dealing with the remarkable progress made in recent years in Japan in the utilisation of water power and in the manufacture of electrical machinery and apparatus were published in the Japanese section of the *Times Trade Supplement* on April 16th, 1921. The following abstracts of the articles, which have been written by Mr. R. Torikai, Professor of Electrical Engineering at the Imperial University of Tokio, will no doubt be read with interest by those who have not perused the originals in our contemporary:—

The Hydroelectric Works.

At the outset the author recalls the fact that Japan is a very narrow and mountainous country. A chain of lofty mountains extending along the whole length of the islands forms a high central axis, on both sides of which hundreds of rivers rush down to the sea. The great difference between the uplands and the plain and the relatively short distance between the mountains and the coast render these rivers swift and unsuitable for navigation. But this physical configuration has a practical advantage as it has endowed Japan with abundant water power resources. The investigations made by the Department of Communications, which controls the supply of electricity, indicate that the islands possess sufficient water power to generate 5,000,000 h.p., and concession rights have so far been granted for 1,000,000 h.p. Applicants for rights have to obtain permission from the Department of Communication and the Department for Home Affairs before they are able to take practical steps in the direction of utilising any water powers, and failure to begin operations within a specified period involves the cancellation of the permit.

The first generating station was established 30 years ago by the City of Tokio, which erected the Sosui Works. A waterway, divided partly into canals and partly into tunnels, was constructed from Lake Biwa to the city. The works was modelled according to the American system in use at that period, and was equipped with alternating current generators at 133 cycles. This station was continued in use until 1912, when the city constructed a modern station of a capacity of 6,000 kW. After the completion of the former the use of hydro-electricity gradually extended all over Japan, and since 1910 a large number of hydro-electric works, with an average capacity of 10,000 kW, have been erected. Not only so, but the high price of coal and the general industrial progress of the country have recently imparted a further impetus to the development of hydro-electric works.

Although the hydro-electric works in size and equipment are not comparable with those in various countries in Europe and America, the professor states that the natural features of the country and the progress already made indicate that hydro-electricity has a great future. Electricity is generated both by water power and from coal, is used for lighting and transport purposes and in chemical and other industries. Electric light is in almost universal use in Japan to-day, and even in small villages and in remote places in the heart of the mountains it is available to the inhabitants.

Coming to consider the generating works in existence, the author remarks that the loftiest mountains are situated in the centre of the country, where the district is known as the Japanese "Alps"; here and at some of the lakes is to be found the greatest head of water. Accordingly the large and typical electrical undertakings have naturally utilised these centres, and have concentrated on the supply of power to the two great industrial centres of Tokio and Osaka. In the case of the Ujikawa Electric Co., Lake Biwa is the source of water power. The capacity of the power house is 35,000 kW, three phase, at 11,000 volts and 60 cycles. This is stepped up to 55,000 volts and transmitted to Osaka, which is 20 miles distant, and is there reduced to 11,000 volts and distributed over the city by means of underground cables, which is the usual system of distribution in the large cities. The company, in conjunction with the Osaka Electric Company, which has an output capacity, generated from coal, nearly equal to the former, has been supplying most of the energy for Osaka. Owing, however, to the growth in the demand having exceeded the output capacity, the Ujikawa Company is now erecting a second station. But instead of providing long tunnels and canals for the conveyance of the water, the company is building a dam across the river Uji and thus raising the level of the water to a sufficient height to generate the necessary power.

The Ujikawa Co. and the Inawashiro Electric Co. are the two largest concerns in Japan. The Inawashiro is a volcanic lake in the north of Japan, and is the source of a river which flows towards the Wakamatsu Plains, the difference in level between the lake and the plains exceeding 1,000 ft. In order to utilise the potentialities of the site, the company proposes to erect four large power houses, two of which have already been completed and are supplying power to Tokio. The generating capacity of the first of the two stations is about 40,000 kW at 11,000 volts and 50 cycles. The voltage is raised to 111,000 and the current transmitted for a distance of 150 miles to Tokio by means of copper conductors on steel towers.

The two companies in question represent the hydro-electric undertakings in the western and eastern districts. Many other companies are also engaged in the business, and the names of five are mentioned as possessing power stations of over 10,000 kW, transmission lines over 50 miles long, and pressures of from 55,000 to 66,000 volts. In addition to these, many new schemes based on the utilisation of the power of the "Alps" have been prepared in order to meet the growing and unlimited demand for supply. In this connection the names of four companies are cited as having been constituted for affording a delivery to Tokio and two for the supply of Osaka. These schemes make provision for a considerable output, ranging from 60,000 kW in one case to 170,000 kW in a second and to 300,000 kW in each of two other projects, while the intended distance of transmission extends over 200 miles at pressures of 165,000 volts.

After referring to the technical error of two frequencies having been adopted of 50 and 60 cycles respectively, Prof. Torikai mentions the problem of the electrification of the railways and the organisation of the supply of power. All the tramway systems and inter-urban lines, he says, are at present operated by electricity, and the Railway Board, which manages the nationalised railways of Japan, has prepared plans for the conversion of the railways to electric traction, which are now before the Parliament.

The Manufacturing Works.

The second article by Prof. Torikai, treating of the Japanese as manufacturers, points out that there were only a few works of small size in the country before the year 1910. These were occupied with the production of the smaller types of machines, whilst almost all the electrical apparatus had to be obtained from other countries. But simultaneously with the growth in the use of electrical power there has been a steady advance in the manufacture of electrical apparatus. Nevertheless the productive capacity in dynamos and motors is still far below the requirements of domestic consumption, and as a consequence these continue to be imported on a large scale.

The author admits that, generally speaking, the electrical manufactures made in Japan do not stand comparison with the products of other countries, and he therefore thinks that the frequent criticism of the crudeness of these and other manufactures calls for some explanation. As a rule this defect is attributed to lack of scientific research. While agreeing that the same progress in research has not yet been made in Japan as in Europe and America, the professor does not consider that this alone accounts for the inferiority in question. In his opinion Japan has made sufficient advance in scientific investigation to meet her industrial requirements, and constant progress is being made in this direction. It has, however, to be borne in mind that Japan is a remote country which has been practically isolated for 2,000 years, and that until recent years the pursuit of business, trade and commerce was despised and regarded with contempt. One result of this isolation, combined with the obstacles of the language, is that Japanese students, in order to prepare themselves for scientific studies and research work, have to spend more than five years in learning foreign languages. It has also to be remembered that until about 50 years ago there were no Japanese workmen trained in modern industries; and all the skilled artisans of to-day have been trained during the past 30 years. On the other hand, their fellow workers in Europe and America have the benefit of generations of skilled training behind them. Under these circumstances the author ascribes the defects of some Japanese manufactures to this lack of experience.

Discussing in detail the manufacturing industry, Prof. Torikai states that at present there are 15 large works which are constructing dynamos of over 1,000 kW, the largest being the Shibaura, the Hitachi, the Mitsubishi, and the Okumara, which are capable of turning out the largest types of machines. Steam turbo-generators of 10,000 to 11,000 kW have been built by the Mitsubishi Co. All the water turbine generators for the Ujikawa Electric Co., each of 7,000 kW at 11,000 volts, and all the dynamos of about the same capacity for the second power station of the Inawashiro Electric Co., were supplied by the Shibaura Co. In other words, all the largest generators in use in Japan have been made by native firms. The Hitachi and Okumara works, which have also made a number of large machines, are also endeavouring to construct hydraulic turbines of moderate size, but this branch has not yet been fully developed.

It is apparent, the author remarks, that Japan is now self-reliant in the production of ordinary dynamos, but these machines are not very much cheaper than those imported from abroad, owing to the fact that Japan is not yet self-supporting in all essential materials, seeing that certain raw and semi-finished products have to be imported. Investigations, however, have recently been made into the question of the availability of domestic supplies of such materials.

The manufacturing works mentioned also produce practically all other electrical apparatus, such as electric railway material, heaters, domestic appliances, &c.; but only a few of the works

manufacture electrical measuring instruments. No difficulties are encountered in the production of meters for switchboards and for general industrial purposes, but the industry is not yet able to construct the finer scientific instruments, where absolute accuracy is a *sine qua non*, such as electrometers, ampere balances, standard resistances, &c.

Prof. Torikai proceeds to remark that the manufacture of electric incandescent lamps has been thoroughly mastered, and all such requirements can now be met by native firms, but owing to patent rights, practically all the lamps are of the "Mazda" type. Some new lines of Japanese invention have recently appeared on the market, and their manufacture will be gradually developed in the future. Besides insulators, which can be produced even for a 220,000-volt line, progress has been made with the production of conducting wires and cables, and the author says that in addition to being able to meet the whole of the demand in the home market, the four existing cable factories are also able to carry on an export trade.

ELECTRICAL IMPORTS AND EXPORTS OF JAPAN.

The following statement shows the import and export trade of Japan in 1919 in electrical and similar goods. For purposes of comparison, figures for 1918 have been added, together with a note of increases or decreases.

IMPORTS.

Country whence imported	1918 Yen	1919 Yen	Inc. or dec. Yen
Posts and materials for electric lines:—			
United States	16,000	151,000	+ 135,000
Insulated electric wire (metal armoured).—			
Total	7,000	71,000	+ 64,000
United States	5,000	3,000	− 2,000
United Kingdom	1,000	68,000	+ 67,000
Insulated electric wire, other.—			
United States	70,000	145,000	+ 75,000
Steam turbines.—			
Total	275,000	836,000	+ 561,000
United States	275,000	588,000	+ 313,000
Switzerland	—	152,000	+ 152,000
Gas engines, petroleum engines, and hot-air engines.—			
Total	505,000	966,000	+ 461,000
United Kingdom	—	38,000	+ 38,000
Sweden	15,000	160,000	+ 145,000
United States	480,000	757,000	+ 277,000
Kwantung Province	5,000	—	− 5,000
Steam engines.—			
Total	463,000	540,000	+ 77,000
United Kingdom	22,000	121,000	+ 99,000
United States	416,000	367,000	− 49,000
Kwantung Province	13,000	—	− 13,000
France	—	35,000	+ 35,000
Germany	3,000	—	− 3,000
Steam boilers and parts.—			
Total	7,535,000	8,335,000	+ 800,000
Kwantung Province	116,000	—	− 116,000
United Kingdom	1,285,000	2,636,000	+1,351,000
United States	6,015,000	5,626,000	− 389,000
Other countries	47,000	—	—
Dynamos, motors, transformers, &c.—			
Total	3,061,000	5,245,000	+2,184,000
Kwantung Province	17,000	10,000	− 7,000
United Kingdom	38,000	187,000	+ 149,000
Sweden	—	292,000	+ 292,000
United States	2,976,000	4,763,000	+1,787,000
Dynamos combined with motive machinery.—			
Total	485,000	736,000	+ 255,000
Kwantung Province	1,000	105,000	+ 104,000
Sweden	—	199,000	+ 199,000
United States	483,000	431,000	− 52,000
Telegraphic and telephonic instruments and parts.—			
Total	91,000	265,000	+ 174,000
United Kingdom	1,000	5,000	+ 4,000
France	1,000	8,000	+ 7,000
Denmark	14,000	3,000	− 11,000
United States	75,000	247,000	+ 172,000
Water turbines and Pelton wheels.—			
Total	82,000	1,787,000	+1,705,000
United Kingdom	—	637,000	+ 637,000
France	13,000	355,000	+ 342,000
Switzerland	32,000	778,000	+ 746,000
Sweden	4,000	—	—
United States	33,000	15,000	− 28,000
Incandescent electric lamps.—			
Total	44,000	72,000	+ 28,000
United Kingdom	4,000	1,000	− 3,000
United States	39,000	70,000	+ 31,000
Filaments for incandescent lamps.—			
Total	320,000	119,000	− 201,000
United Kingdom	107,000	15,000	− 92,000
France	7,000	13,000	+ 6,000
United States	202,000	89,000	− 113,000
Submarine telegraph or telephone cables.—			
United States	6,000	—	− 6,000
Wattmeters.—			
Total	460,000	519,000	+ 59,000
United Kingdom	23,000	6,000	− 17,000
Switzerland	201,000	198,000	− 3,000
United States	236,000	292,000	+ 56,000
France	—	21,000	+ 21,000
Ammeters and voltmeters.—			
Total	218,000	253,000	+ 35,000
United Kingdom	1,000	1,000	—
United States	217,000	250,000	+ 33,000
Accumulators.—			
Total	26,000	100,000	+ 74,000
United Kingdom	—	3,000	+ 3,000
Germany	4,000	—	− 4,000
United States	22,000	97,000	+ 75,000
Carbon for electrical use.—			
Total	275,000	682,000	+ 407,000
United Kingdom	20,000	50,000	+ 30,000
France	3,000	4,000	+ 1,000
United States	251,000	627,000	+ 376,000

EXPORTS.

Country to which exported	1918 Yen	1919 Yen	Inc. or dec. Yen
Electrical machinery and parts thereof.—			
Total	3,984,000	4,443,000	+ 459,000
China	1,005,000	1,409,000	+ 404,000
Kwantung Province	1,513,000	1,687,000	+ 174,000
Hong Kong	62,000	66,000	+ 4,000
British India	207,000	134,000	− 73,000
British S.S.	53,000	35,000	− 18,000
Dutch India	275,000	446,000	+ 171,000
French Indo-China	11,000	33,000	+ 22,000
Asiatic Russia	13,000	160,000	+ 147,000
Philippine Islands	34,000	43,000	+ 9,000
Siam	16,000	39,000	+ 23,000
United Kingdom	33,000	72,000	+ 39,000
France	245,000	39,000	− 206,000
United States	2,000	6,000	+ 4,000
Canada	10,000	5,000	− 5,000
Chile	20,000	17,000	− 3,000
Argentine	20,000	9,000	− 11,000
Egypt	28,000	7,000	− 21,000
Cape Colony and Natal	83,000	24,000	− 59,000
Australia	296,000	155,000	− 141,000
New Zealand	53,000	27,000	− 26,000
Peru	—	5,000	+ 5,000
Telephones and parts thereof.—			
Total	421,000	630,000	+ 209,000
China	182,000	143,000	− 39,000
Kwantung Province	172,000	218,000	+ 46,000
Hong Kong	4,000	1,000	− 3,000
British India	4,000	5,000	+ 1,000
Dutch India	42,000	36,000	− 6,000
Asiatic Russia	12,000	220,000	+ 208,000
Electric lamps.—			
Total	2,570,000	1,677,000	− 893,000
China	482,000	456,000	− 26,000
Kwantung Province	242,000	196,000	− 46,000
Hong Kong	157,000	145,000	− 12,000
British India	267,000	39,000	− 228,000
British S.S.	25,000	17,000	− 8,000
Dutch India	108,000	39,000	− 69,000
French Indo-China	31,000	19,000	− 12,000
Asiatic Russia	37,000	60,000	+ 23,000
Siam	51,000	23,000	− 28,000
United Kingdom	143,000	3,000	− 140,000
France	135,000	11,000	− 124,000
Italy	61,000	65,000	+ 4,000
United States	53,000	351,000	+ 298,000
Canada	239,000	54,000	− 185,000
Peru	18,000	13,000	− 5,000
Chile	15,000	20,000	+ 2,000
Argentine	17,000	1,000	− 14,000
Brazil	1,000	1,000	− 16,000
Egypt	55,000	26,000	− 29,000
Cape Colony and Natal	28,000	9,000	− 19,000
Australia	379,000	66,000	− 313,000
New Zealand	11,000	10,000	− 1,000
Philippine Islands	7,000	34,000	+ 27,000

Country to which exported	1918 Yen	1919 Yen	Inc. or dec. Yen
Electric insulated wire.—			
Total	8,324,000	8,411,000	+ 87,000
China	1,312,000	1,445,000	+ 133,000
Kwantung Province ...	622,000	1,444,000	+ 822,000
Hong Kong	173,000	203,000	+ 30,000
British Indies	1,349,000	195,000	−1,154,000
British S.S.	119,000	135,000	+ 16,000
Dutch India	1,025,000	1,660,000	+ 635,000
French Indo-China ...	40,000	51,000	+ 11,000
Asiatic Russia	70,000	906,000	+ 836,000
Philippine Islands ...	44,000	23,000	− 21,000
Siam	44,000	96,000	+ 52,000
United Kingdom	63,000	—	− 63,000
France	10,000	—	− 10,000
United States	7,000	6,000	− 1,000
Peru	13,000	110,000	+ 97,000
Chile	86,000	111,000	+ 25,000
Argentine	305,000	367,000	+ 62,000
Brazil	—	14,000	+ 14,000
Egypt	107,000	20,000	− 87,000
Cape Colony and Natal ...	214,000	132,000	− 82,000
Australia	2,485,000	1,315,000	−1,170,000
New Zealand	231,000	141,000	− 90,000

Yen=2s. 0¼d.

THE FARADAY SOCIETY.

I.—The Electrolytic Recovery of Zinc.

At the March meeting of the Faraday Society, after the delivery by Prof. Porter of the Presidential Address (reported in our issue of April 8th, p. 439), a discussion took place, based on an exhaustive paper presented by Mr. S. Field, on the electrolytic process for the recovery of zinc from its ores. Abroad, notably in America and Tasmania, the process has already to a considerable extent displaced the old distillation method. Thus at Anaconda the plant in operation has a capacity of 100 tons a day, and that at Trail in British Columbia 40 tons a day. At Risdon, in Tasmania, a 10-ton a day plant is in operation, while extensions up to 100 tons a day are being rapidly pushed forward. It is clear, therefore, that the technical difficulties associated with the method have been surmounted, and the superiority of the product over distilled zinc (it reaches a 99.95 per cent. grade) being quite unquestionable, the matter of its applicability in any country becomes essentially an economic one. Not entirely economic, however, for there is a question of broad national policy involved, and it will be recalled that during the war our dependence upon oversea supplies of spelter was a matter which gravely affected the national security. During the past five years the average annual production of zinc in Great Britain has been 50,000 tons, against a consumption of 150,000, although at present it has probably fallen to some 20,000 tons. This fall Mr. Field ascribes mainly to the approaching exhaustion of the supplies of the high-grade ores required by the distillation process, and he puts forward the thesis that the industry can be saved for the country by the introduction of the electrolytic method which can be applied to the treatment of the low-grade and complex ores still plentiful in Cornwall, Scotland, and elsewhere. The contention stands or falls depending on the cost of electrical energy. Now, the process described by Mr. Field consumes 3,200 kWh per ton of cathode zinc for the deposition and some 800 for subsidiary purposes, 4,000 units per ton in all. The author was of opinion that steam-generated energy from low-grade fuel on the scale required for a 10 ton a day plant can be sold for .35d. a unit and for .32d. on a 20 ton basis. Taking the figure at one-third of a penny, we arrive at £5 11s. per ton of cathode metal, a figure which, if substantiated, makes the process a possible one in this country. The discussion naturally turned round this question of price of electrical energy, but it did not go very far. The matter is admittedly in a state of flux at the moment. As Mr. W. R. Cooper pointed out, the advocates of the process should stir up the Electricity Commissioners. They certainly should, if the experience quoted by Mr. H. M. Ridge—himself an experienced worker in this field—be typical. Mr. Ridge, even before the war, was unable to contract for the supply of electricity in bulk for electrochemical purposes for less than 85s. per h.p.-year, and that figure would now have to be doubled. On the other hand, the Tasmanian electrolytic zinc industry was obtaining electricity for 40s. or 45s. per h.p.-year. Mr. Donald F. Campbell thought that Mr. Field's figures were not impossible of achievement, for the pre-war cost of generating power with gas from coke ovens or waste colliery products was about .33d. The electrolytic process was exceptionally favourable to the generating station in that both load factor and power factor were high. Whether the process was possible here depended on the price of coal; that it would in time displace distillation was extremely probable when it was remembered that the old process demanded 5 tons of coal to produce 1 ton of zinc, and that the advantages as regards labour and purity of product were all with electrolysis.

We proceed to the consideration of the process itself. Briefly described, this consists in calcining sulphide ores to render the zinc soluble in dilute sulphuric acid, by which it is extracted as zinc sulphate. The sulphate solution is purified and then electrolysed with insoluble anodes. The zinc is deposited in an easily detachable form, and it is finally melted down into ingots. The spent electrolyte, rich in free sulphuric acid, is used for leaching a fresh supply of calcined ore. It contains some 3 per cent. zinc and 10.5 per cent. free acid.

It is clear that the essential features of the process are the purification of the electrolyte and the subsequent electrolysis, and the success of the latter depends almost entirely on the degree to which deleterious impurities have been removed from the electrolyte. These impurities are: (1) iron, arsenic, antimony, and cobalt, which are removed by oxidising agents such as air, ozone, lead, and manganese dioxide; (2) copper, cadmium, and nickel, which are removed by means of zinc dust, the presence of a small amount of mercury as sulphate helping the removal of these metals and ensuring complete removal of the cobalt. In the paper Mr. Field discusses the methods of purification in some detail, and these deserve close study. At the meeting he showed in a striking fashion the harmful results on the deposited zinc of anything more than some five parts of cobalt and 0.2 part of nickel per 1,000,000. These metals, in fact, are the impurities most commonly met with, and the most insidious. It was not until this fact was realised and methods devised for their almost complete elimination that electrolytic zinc extraction became practicable. Both cobalt and nickel accumulate in the solution and act corrosively, but with a curiously marked difference. The former promotes the formation of pinholes that penetrate the thickness of the deposit, which then quickly dissolves from the back in contact with the cathode. The effect of nickel is to engender small holes which widen, and ultimately a deep and sharp hole is cut clean through the zinc deposits. Both effects are most curious and interesting.

The neutral purified solution of zinc sulphate is acidified until it contains 3 per cent. free sulphuric acid and 8 per cent. metallic zinc, and it is then electrolysed, using lead anodes and aluminium cathodes. The current maintains the desired optimum temperature of 40-45 deg. C. Each cell, at that temperature, absorbs 3.35 volts and gives a current efficiency of 90 per cent. A series of cells is arranged in cascade, the solution flowing from one to the next. Electrolysis is allowed to continue until the acidity rises from 3 to 10.5 per cent., and the zinc content falls from 8 to 3 per cent. An inspection of the accompanying current-efficiency curve makes it clear why these limits of acidity are chosen, and no further comment is necessary. The diagram also shows

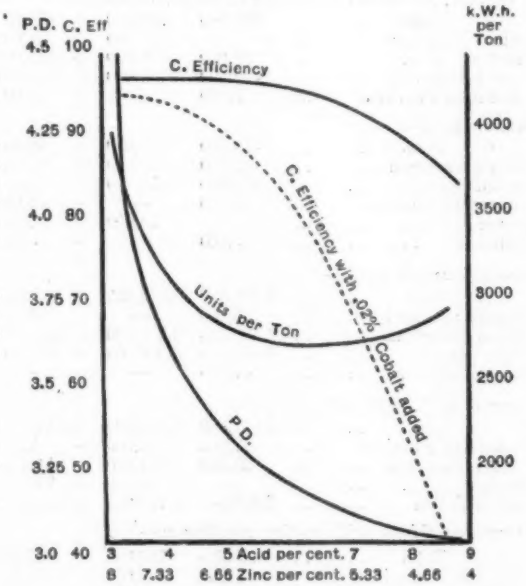


Fig. 1.—Current Efficiency Curve.

that the average energy consumption is some 3,200 kWh per ton of zinc deposited.

The deposits, which are easily detached from the aluminium cathodes, when melted down assay 99.95 per cent. zinc, the slight impurities consisting of 0.02 per cent. lead, 0.02 per cent. cadmium, and 0.01 per cent. copper and iron.

The process has certainly been worked out by Mr. Field and his colleagues with extraordinary care and thoroughness. Of its technical success there can be no question. One must hope that the zinc market and the availability of sufficiently cheap energy will, when times become more stabilised, enable the electrolytic process to compete on fair terms with zinc smelting abroad so that this country may become assured of a home zinc industry producing the metal from native ores.

II.—Electrolytic Iron.

A paper presented by Mr. W. E. Hughes gave the results of a study of the crystalline forms of electro-deposited iron and the effect of acid upon its structure. The experiments described dealt with deposits obtained from a ferrous chloride bath containing calcium chloride, and it was found that structurally they fall into two types, *normal* or *fibrous*, depending on the conditions prevailing. A close connection between the macroscopic and microscopic features of the deposits was observed, thus enabling an operator to form an opinion as to the internal structure of his deposits from their external features. Thus, (*a*) a very close-grained, matt, and, so far as the unaided eye can see, non-crystalline exterior connotes a fibrous interior; while (*b*) a crystalline external appearance is the mark of a coarse grained internal structure —one that approaches more or less closely to the normal type. (*c*) A bright metallic appearance indicates that the internal structure is of such fine grain that it is visible at higher magnification only.

The conditions which determine the class of deposit were generalised by the author as follows:—

1. Acidity causes the deposit to possess a fibrous structure; excess of acid causes the structure to be of extremely fine grain.

2. As the acid diminishes in concentration the structure of the deposit changes from the fibrous to the normal type.

3. Undisturbed deposition results in a structure that becomes coarser and coarser in grain size as the deposition continues. This increasing coarseness is marked, macroscopically, by an increase in the size of the crystals on the surface of the deposit.

III.—The Electrolytic Reduction of Glucose.

Prof. Alexander Findlay and Mr. V. H. Williams presented a note on "The Electrolytic Reduction of Glucose." Previous work on this subject has yielded conflicting results, and the authors have, therefore, made a careful study of the reduction under varying conditions of temperature, current density, and current concentration, using both graphite and pure lead electrodes. The reduction of glucose to the corresponding hexahydric alcohol is in itself a process of importance, but so far as the electrolytic method is concerned negative results were obtained. It is suggested that the production of formic acid and a pentose interfered with the production of the alcohol.

NORTH WALES AND CHESTER ELECTRICITY DISTRICT.

We have received the following communication from the Electricity Commission:—

The Electricity Commissioners having considered the evidence submitted at the recent inquiry at Llandudno into the two schemes submitted respectively by the Corporation of Chester and by the North Wales Power & Traction Co., Ltd. (hereinafter called "the company"), have arrived at the following conclusions:—

1. The area provisionally determined received general assent except in respect of certain districts on the eastern side of the area.

The Electricity Commissioners have decided to confirm the boundaries of the district as provisionally determined, subject to the inclusion of the Municipal Borough of Congleton, the urban districts of Alsager and Sandbach, and the rural district of Congleton, and to the exclusion of the urban districts of Northwich, Middleswich, and Winsford, and the rural district of Northwich.

2. The scheme promoted by the Corporation of Chester contains proposals for (*a*) the development of a series of low-fall water power stations (without storage) on the river Dee between Llangollen and Erbistock; (*b*) the establishment of a new steam generating station on the Dee estuary; (*c*) the temporary utilisation of supply from H.M. factory, Queensferry; (*d*) the establishment of a small water power station in the Vale of Clwyd; and (*e*) ultimate co-operation with the company for a large supply from their hydro-electric system.

From the evidence submitted to them, the Commissioners have come to the conclusion that the engineering proposals in this scheme cannot be approved, inasmuch as (*a*) it would be impracticable at the present time to develop low-fall water-power stations on the river Dee; and in any event, such development would have necessitated a stand-by steam plant for ensuring reliability of the supply; (*b*) the erection of a coal-fired station on the Dee estuary is unnecessary, and the cost of generation at such a station would compare unfavourably with that of a supply from the North Wales hydro-electric system; (*c*) no definite proposals are included for the full development of the water-power resources of the western part of the district.

Moreover, the scheme, which provides for the establishment of a Joint Electricity Authority consisting of representatives of local authorities and bodies prepared to accept financial responsibility, failed to secure adequate public support.

The Commissioners consider that a supply from H.M. factory, Queensferry, should be utilised temporarily. The information given with regard to the development in the Vale of Clwyd was insufficient to warrant a favourable opinion, although the Commissioners recognise that this small water power may hereafter be utilised.

3. The scheme promoted by the company provides for the utilisation of the water power resources of the western area by the improvement of Cwm Dyli, the further development of Dolgarrog, and a new and extensive development at Maentwrog.

The Commissioners are satisfied that the engineering developments at Cwm Dyli and Dolgarrog are sound. Comparisons with independent and earlier reports have also established the soundness of the proposed first development at Maentwrog, while an examination of the scheme for the second development has reasonably satisfied the Commissioners of its feasibility.

Subject to the Commissioners being satisfied that the agreement between the company and the Aluminium Corporation, Ltd., who own the Dolgarrog works will be such as to safeguard the power supply therefrom, the Commissioners have decided to accept the engineering proposals of the company's scheme. The adoption of this scheme will, in their opinion, ensure an ample supply of electricity to meet the requirements of North Wales with a sufficient surplus for distribution at commercial rates to districts outside North Wales. Such an additional outlet will enable the full economic development of the available water power to be undertaken.

The acceptance of the scheme by the Commissioners will be subject to (i) the company obtaining any further statutory powers which may be necessary; (ii) the company satisfying the Commissioners as to their ability to raise the capital required; and (iii) a consideration of the amount payable by the company in respect of back dividends.

The Commissioners are satisfied that the provisions of Sections 43 and 45 of the North Wales Electric Power Act, 1904, for the revision of maximum prices and of the relation between price and dividend sufficiently safeguard the public.

4. A Joint Electricity Authority is necessary for the district for the purpose of local supervision in the public interests over the development and co-ordination of the supply of electricity, more particularly as important natural sources of power are being utilised. Having regard, however, to the local circumstances, the best interests of the district would be served by the delegation or transfer by the Joint Electricity Authority to the company of its powers of supply with certain exceptions.

The Electricity Commissioners have accordingly decided to prepare a draft order providing for the establishment of a Joint Electricity Authority for the district defined in paragraph 1.

(i) In settling the representation on the Joint Electricity Authority, the Commissioners will give due consideration to the proposals embodied in the scheme submitted by the Chester Corporation, and to the representations made by various local authorities, but they will have regard to the necessity for constituting a body which will not be too large to be efficient.

(ii) The order will provide for the delegation or transfer to the company, by deed to be approved by the Commissioners, of such of the powers of the Joint Electricity Authority as the Commissioners may determine.

The intention of the Commissioners is that while the supply of energy in bulk throughout the whole district shall be in the hands of the company, such powers shall be reserved to the Joint Electricity Authority as will enable it to facilitate the development and co-ordination of supply by the company and other authorised undertakers in the area, and in particular to control the development of distribution in all present unoccupied areas (subject to the existing right of local authorities or companies to apply for special orders to establish local distribution undertakings); to supervise generally the exercise by the company of such of the powers of the Joint Electricity Authority as may be delegated or transferred to the company; and to advise the Commissioners on matters affecting the supply in the district.

(iii) The order will embody the outlines of the technical scheme to be undertaken by the company, but will provide that modifications thereof may be made with the approval of the Commissioners.

(iv) The order will require the Joint Electricity Authority to submit within a period of two years from the date of its formation proposals for securing a supply in unoccupied areas where there is a reasonable prospect of such supply being remunerative.

(v) The order will not impose upon the Joint Electricity Authority any financial responsibility other than its own administrative expenses, which will be met by contributions from each of the interests represented on the Authority.

Pending the establishment of the Joint Electricity Authority, the Commissioners will ask the parties concerned to form a small provisional committee, with whom the Commissioners can consult from time to time with regard to any development of supply in the district.

The observations of the parties represented at the recent inquiry will be invited on the clauses of the draft order before the Commissioners hold the further inquiry required by Section 5 (4) of the Electricity (Supply) Act, 1919.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

10,520. "Gasfilled incandescent electric lamps." E. Y. Robinson. April 11th.

10,521. "Incandescent electric lamps." E. Y. Robinson. April 11th.

10,526. "Portable electric sanding and planing machine." H. E. Brand and J. A. Burgoyne. April 11th.

10,550. "Electric switch, fuse, &c., boxes." W. J. Woodrow. April 11th.

10,561. "Transformers for high voltages." E. Haefely et Cie. April 11th. (Switzerland, October 16th, 1920.)

10,575. "Single-fluid primary cell." F. Weatherill. April 11th.

10,585. "Apparatus for regulating asynchronous electric machines by means of a commutator machine arranged behind." E. C. R. Marks (Siemens-Schuckertwerke). April 11th.

10,591. "Telephone exchange systems." A. H. Adams. April 11th. (United States, May 13th, 1920.)

10,595. "Telephone systems." Ges. für Drahtlose Telegraphie. April 11th. (Germany, April 12th, 1920.)

10,597. "Amplifiers for telephone circuits." Soc. Industrielle des Téléphones. April 11th. (France, November 18th, 1920.)

10,599. "Transformation of alternating electric pressures and currents to direct pressures and currents, &c." S. A. Stigant. April 11th.

10,614. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. April 11th. (United States, April 19th, 1920.)

10,619. "Speed accumulator for bicycles." P. S. Nixon. April 12th.

10,629. "Protective covering for electric refill batteries." G. P. Golden. April 12th.

10,638. "Cartridge fuse for electrical circuits." G. W. Humphry. April 12th.

10,639. "Earth connection devices for pipes, cables, sheaths, &c." G. W. Humphry. April 12th.

10,643. "Electrical signalling, &c., apparatus for use in trains, factories, mines, &c." L. G. A. C. D. Gaunt. April 12th.

10,651. "Electrically-illuminated hand mirror." C. E. Toms. April 12th.

10,663. "Electric lamp holders, &c." G. F. A. Stone. April 12th.

10,671. "Electric batteries." Hewittic Electric Co., Ltd., formerly Westinghouse Cooper Hewitt Co., Ltd. April 12th. (France, April 15th, 1920.)

10,680. "Automatic compressed-air brake for tramways, &c." E. Seguin. April 12th. (France, April 15th, 1920.)

10,681. "Pneumatic brakes for tramways, &c." E. Seguin. April 12th. (France, April 19th, 1920.)

10,687. "Motor for generating power." F. Macdonald. April 12th.

10,690. "Method for preventing disturbing induction between adjacent leads carrying approximately the same high-frequency waves." H. A. Gill (Deutsche Telephonwerke Ges.). April 12th.

10,700. "Control of alternating-current electric motors." Metropolitan-Vickers Electrical Co., Ltd. April 12th. (United States, July 30th, 1920.)

10,701. "Control of alternating current electric motors." Metropolitan-Vickers Electrical Co., Ltd. April 12th. (United States, July 19th, 1920.)

10,702. "Electro-magnetic switches." British Thomson-Houston Co., Ltd. (General Electric Co.). April 12th.

10,705. "Trolley pole safety appliance for electric trams, &c." P. M. de C. Ireland. April 12th.

10,730. "Switch arrangement sending and receiving electrical oscillations of low frequency." Dr. E. F. Huth Ges. April 12th. (Germany, April 12th, 1920.)

10,746. "Sparking plug shield." S. Sims. April 13th.

10,761. "Galvanic battery." J. Hossack. April 13th.

10,765. "Electric baling presses for loose materials." J. H. Hindle and T. Hindle. April 13th.

10,770. "Illuminated signs." Studien Ges. fur Elektrische Beleuchtung. April 13th.

10,776. "Chronometric electric switches, &c." L. Burn, W. W. Stainer, and C. J. Stewart. April 13th.

10,795. "Receivers for telephones." A. Humphrey and E. Kempner. April 13th.

10,798. "Dynamo-electric machines." M. Dewhurst. April 13th.

10,799. Electrical apparatus." E. L. W. Byrne. April 13th.

10,800. "Plug and socket connectors." A. P. Lundberg, G. C. Lundberg, P. A. Lundberg, and G. Pegg. April 13th.

10,802. "Contact breakers for electrical ignition for automobile internal combustion engines." A. Demont. April 13th.

10,803. "Telautography." H. G. Bartholomew. April 13th.

10,809. "Enclosed fuses." A. L. Eustice. April 13th.

10,813. "Variable speed power transmitting devices." E. C. R. Marks (Marathon Electric Manufacturing Co.). April 13th.

10,822. "Retarding devices for relays." W. H. Petersen and Allmanna Svenska Elektriska Aktiebolaget. April 13th.

10,823. "Inverse time limit relays." W. H. Petersen and Allmanna Svenska Elektriska Aktiebolaget. April 13th.

10,849. "Telephone systems." H. H. Gelman." April 13th.

10,883. "Control devices for electric generators." R. Bosch Akt.-Ges. April 14th. (Germany, May 3rd, 1920.)

10,892. "Contröl of electric lifting magnets." H. E. Bowen, W. Brooke, E. Holme & Co., Ltd., Steel, Peech & Tozer, Ltd. April 14th.

10,903. "Combined switch and petrol tap for motor cars, &c." W. S. Brigham. April 14th.

10,923. "Apparatus for transmitting, receiving, or reproducing sound." A. F. R. Cotton and E. W. C. Russell. April 14th.

10,935. "Three electrode bulbs or valves." Soc. Anon. pour l'Exploitation des procedes M. Leblanc-Vickers, formerly Soc. Anon. pour l'Exploitation des procedes Westinghouse-Leblanc. April 14th. (France, April 15th, 1920.)

10,939. "Electric starters for internal combustion engines." Scintilla. (Switzerland, April 14th, 1920.)

10,958. "Electric lighting for motor cycles, &c." S. L. Price. April 14th.

10,959. "Dynamo-electric machines." S. L. Price. April 14th.

10,977. "Generators of electric current." P. Belyavin. April 15th.

10,987. "Non-glare head-light for motor cars, &c." A. A. Green. April 15th.

10,990. "Rheostats." S. T. Quilliam (Electric Railway Improvement Co.). April 15th.

11,007. "Transmission systems with electric diaphragms for sound boxes for talking machines." H. Hurm. April 15th. (Belgium, April 19th, 1920.)

11,026. "Means for suspension of electric contact wires." L. N. Reddie (Consorzio per Elettrotrazione). April 15th.

11,035. "Machines for slotting insulation between commutator bars of electric machines." J. Phillips. April 15th.

11,038. "Timing devices for ignition apparatus of internal combustion engines." R. S. Bowen. April 15th. (United States, April 17th, 1920.)

11,049. "Electro-metallurgy." British Thomson-Houston Co,, Ltd. (General Electric Co.). April 15th.

11,061. "Signalling systems, particularly wireless modulation systems." J. Scott-Taggart (Radio Communication Co., Ltd.). April 15th.

11,065. "Gas producers, electric furnaces, crucible furnaces, &c." H. B. Clapp & Ferolite, Ltd. April 15th.

11,069. "High-frequency electrical apparatus." J. B. Bower. April 15th.

11,070. "Electric switch." A. H. Hunt. April 15th.

11,080. "Sparking plugs." H. Molla. April 16th. (France, May 10th, 1920.)

11,089. "Combined spark intensifier and sparking plug tester for internal combustion engines." E. Arden Pye, H. Singer, and E. Taylor. April 16th.

11,091. "Trolley head for electric tramcars, &c." C. Noble. April 16th.

11,120. "Means for reducing capacitative ground current in high-tension transmission systems." Allmanna Svenska Elektriska Aktiebolaget. April 16th. (Sweden, April 16th, 1920.)

11,121. "Arrangement for neutral point resistances for high-tension transmission systems." Allmanna Svenska Elektriska Aktiebolaget. April 16th. (Sweden, April 16th, 1920.)

11,125. "Electric switches." W. P. Gilbart and R. A. Griffiths. April 16th.

11,127. "Electric lighting and ignition systems for motor vehicles." E. A. Watson & C.L.I. Manufacturing Co., Ltd. April 16th.

11,128. "Safety fuses." A. L. Eustice. April 13th.

11,131. "Quick make and break electrical switches." F. Shergold and Edison Swan Electric Co., Ltd. April 16th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1914.

17,733. "Electric metallic filament incandescent lamp." Kende. July 27th, 1914.

1918.

12,266. "Electric heaters." J. R. Quain. July 27th, 1918. (Cognate application 13,733/18.) (160,844.)

1919.

6,749. "Unidirectional radio receiving systems." British Thomson-Houston Co., Ltd. (General Electric Co.). March 18th, 1919. (160,846.)

22,428. "Electrical and other wire or cord or flex adjusters." E. Westrup and O. F. Westrup. September 12th, 1919. (160,860.)

23,051. "Combined double pole electric switch and plug." W. E. Watson. September 19th, 1919. (160,863.)

23,955. "Electric insulators." V. Tedeschi. September 30th, 1919. (Italy, December 5th, 1918.) (136,142.)

23,956. "Electric insulators." V. Tedeschi. September 30th, 1919. (Italy, February 18th, 1919.) (Addition to 136,142.) (139,148.)

23,977. "Electric switches." A. Anzani. September 30th, 1919. (France, October 2nd, 1918.) (133,309.)

29,630. "Electric relays." Siemens Bros. & Co., Ltd., W. H. Grinsted, and E. A. Petithory. November 28th, 1919. (160,888.)

29,783. "Insulating and anchoring device for electric lamp holders and other electric fittings." B. Deakin. November 29th, 1919. (160,890.)

29,980. "Induction motors." Colner Elektromotorenfabrik Johannes Bruncken. February 7th, 1918. (136,156.)

30,120 "Induction motors." Colner Elektromotorenfabrik Johannes Bruncken. July 17th, 1919. (Addition to 136,156.) (160,894.)

32,454. "Telegraph printing systems." Automatic Telephone Manufacturing Co., Ltd., H. H. Harrison, and S. R. Smith. December 29th, 1919. (160,916.)

32,703. "Magneto-electric machines." R. B. North and A. M. Allen. December 30th, 1919. (160,931.)

32,707. "Audible and visible electric signalling systems for calling attendants." M. V. Ely and Foster Engineering Co., Ltd. December 30th, 1919. (160,932.)

32,719. "Burglar and like alarm apparatus." J. O. Attaque. December 30th, 1919. (160,934.)

32,830. "Radio receiving systems." British Thomson-Houston Co., Ltd. (General Electric Co.). December 31st, 1919. (160,941.)

1920.

549. "Electrodes for use in electric welding or fusion deposition of metals." Quasi-Arc Co., Ltd., and A. P. Strohmenger. January 7th, 1920. (160,957.)

879. "Electric heating device." Electric Heating & Hardware, Ltd., and F. J. Wineberg. January 10th, 1920. (160,971.)

1,101. "Wireless direction finding systems." F. Murphy. January 13th, 1920. (160,975.)

1,134. "Commutators for dynamo-electric machines." A. E. White (Toledo Standard Commutator Co.). January 13th, 1920. (160,978.)

1,249. "Portable radio telegraphic and telephonic apparatus." R. M. Radio, Ltd., and H. St. J. De A. Donisthorpe. January 14th, 1920. (160,981.)

2,688. "Electric resistances." British Thomson-Houston Co., Ltd. (General Electric Co.). January 28th, 1920. (161,011.)

3,650. "Incandescent electric lamps." H. J. Osborn. February 6th, 1920. (161,026.)

12,222. "Spark plugs." J. Iacono and S. E. Pace. November 27th, 1918. (142,811.)

15,791. "Spark plugs." W. Housman. November 26th, 1917. (144,713.)

16,911. "Electric starting device for internal combustion engines." R. Bosch Akt.-Ges. May 26th, 1919. (145,527.)

18,170. "Dynamo-electric machines." Locknitzer Eisenwerk Ges. December 2nd, 1919. (154,878.)

18,889. "Telemotor." R. Macgregor. July 6th, 1920. (Patent of addition not granted.) (161,102.)

19,350. "Conveyance and distribution of high-frequency electric currents." Ges. für Drahtlose Telegraphie. May 28th, 1919. (147,447.)

19,504. "Manufacture of composite conductors for dynamo-electric machines and other electric apparatus." Siemens-Schuckertwerke Ges. December 14th, 1917. (147,571.)

19,533. "Electrically controlled valve gear of a hydraulic gun-laying mechanism." F. Krupp Akt.-Ges. November 10th, 1917. (147,596.)

23,696. "Cooling arrangements for dynamo-electric machinery." Siemens Schuckertwerke Ges. October 8th, 1919. (Addition to 138,342.) (152,325.)

23,961. "Thermionic valves and the like." H. L. Crowther and W. Makower. February 2nd, 1920. (Divided application on 30,355/19.) (161,115.)

27,004. "Process for regulating the voltage in metal vapour rectifier installations." Akt.-Ges. Brown, Boveri et Cie. September 22nd, 1919. (151,612.)

32,887. "Magnetos for internal combustion engines." Fabriques des Montres Zenith. December 29th, 1919. (156,086.)

33,063. "Wireless transmission of speech." E. C. Hanson. June 18th, 1917. (154,537.)